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DECEMBER 1958

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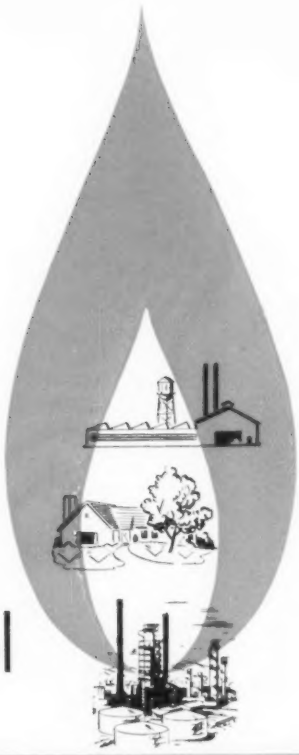

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GAS

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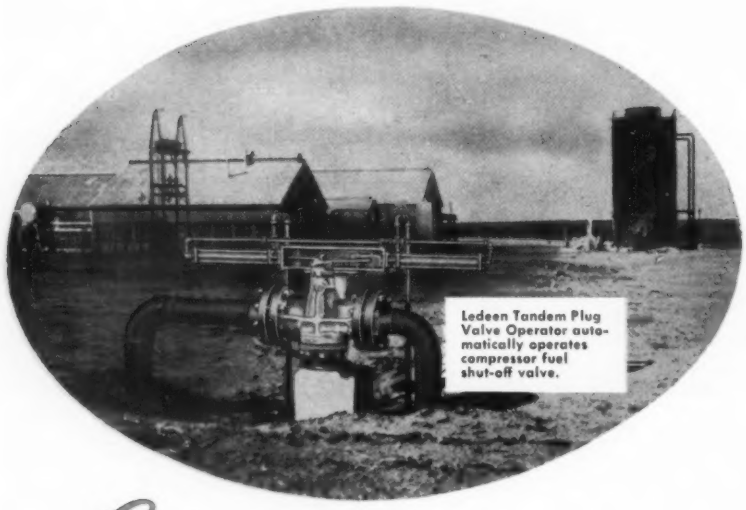

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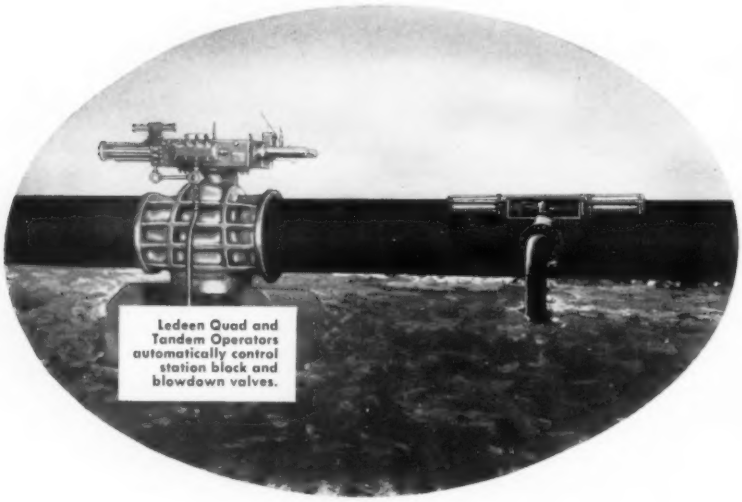

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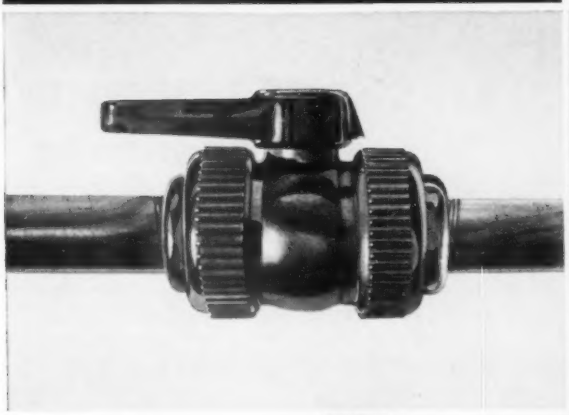

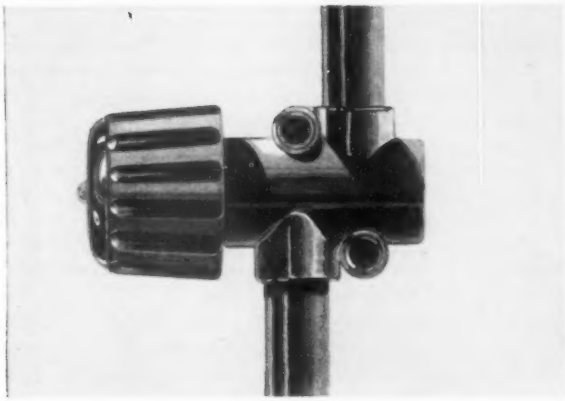

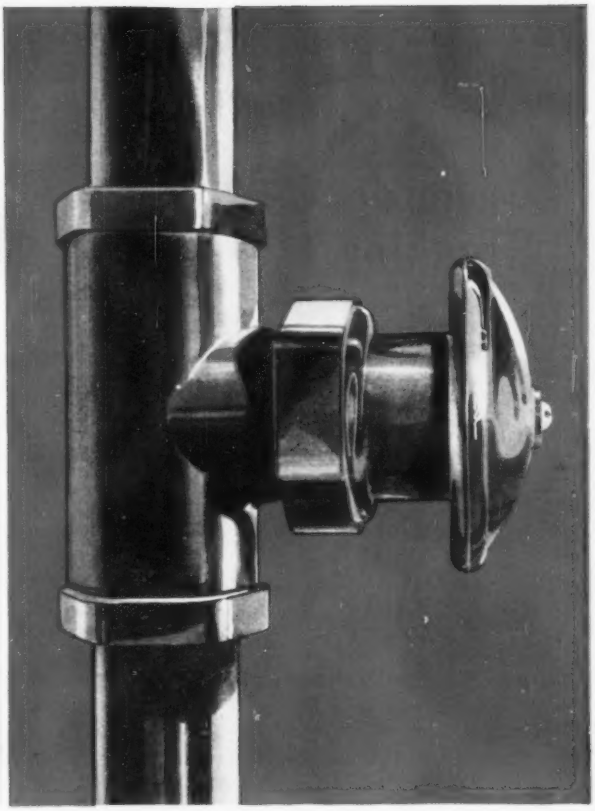

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GAS

DECEMBER 1958

Thermally Thinking

AT year's end, perhaps some informal comments on the state of the gas business are appropriate. Actually, we are not too concerned about whether they are appropriate or not since we have no reputation for producing literature aimed to soothe everyone.

It is certain that national politics have veered to a more liberal philosophy. Ontology and cosmology will, then, direct altruism from the federal Treasury into popular benefits.

Highly important to the gas industry in 1959 will be the quiet progress of publicly owned gas systems. This way of doing things meshes with the aesthetic side of a liberal policy. Municipal gas systems have been on the increase even under our so-called conservative policy. The increase can be accelerated under liberalism. We subscribe to more private initiative and less government (big or little) in the gas business. It is time for gas people to come alert. Privately owned gas systems must become aggressive and learn to "sell" their operations and service. There is no better, more efficient way than private enterprise. Yet, we sit around and let others convince people that there is.

Another random thought: failing hopes for a new gas bill will be even glimmer during 1959, but not hopeless. The Congress will be lead by Martin and Dirksen, for the Republicans, and Rayburn and Johnson, for the Democrats. But the "forces" of both sides will be laced with "moderns" and "freshmen," hence, harder to control. At the same time there is much talk about gas industry unity with much less (if any) actual demonstrative action toward this objective.

The "Borden Commission" recommendations will certainly delay appreciably any further importations of Canadian-produced natural gas. By two years would be a good guess. This is particularly important to California. It is not so important to the Midwest since our own FPC has been doing a pretty good job of constant delay (over three years) and requires no help on that score from our Canadian friends.

The delay is obvious because the First Report of the Royal Commission is simply recommendations. Enacting legislation will have to be forthcoming when Parliament meets again in January. Then, the whole thing will be assaulted by politics and nationalism. It will take time for any or all of the Borden Commission recommendations to become law.

We have a feeling of malignity to noting that in comment on the letter from Canada's Minister of Trade and Commerce (then), C. D. Howe, to Trans-Canada Pipe Lines Ltd., relating to, and assuring action for authorization of 200 MMcf per day for export to TGT when the latter secured permit from the FPC, the Borden Commission said this:

"On Sept. 28, 1955, when the then Minister of Trade and Commerce addressed his letter to Trans-Canada, Trans-Canada's requirements of natural gas for Canadian consumption were entirely different from the requirements that now exist. Had an import permit been granted by the Federal Power Commission of the United States of America at SOMETIME DURING THE INTERVENING THREE YEARS (our caps), it may well have been that Trans-Canada would have been in position to supply gas and make application to the Government of Canada for an export license, but such is not presently the situation."

It is also distressing to observe that the Canadian government seemingly would join some of the countries to the south of us in the "Banana Belt" where we are not at all amazed to see the assurances of a previous government either ignored or overturned by a new government. However, to the north of us we see a Canadian government give assurance to Trans-Canada—and, considering effect, to the North American gas industry—that action would be taken to authorize the export to the United States. Alas, this was done under a Liberal Canadian government and the Borden Commission would have Mr. Diefenbaker's government ignore this little commitment. The gas industry throughout this continent will be watching the action of the Canadian government in this matter.

J. Fred Ebdon
EDITOR

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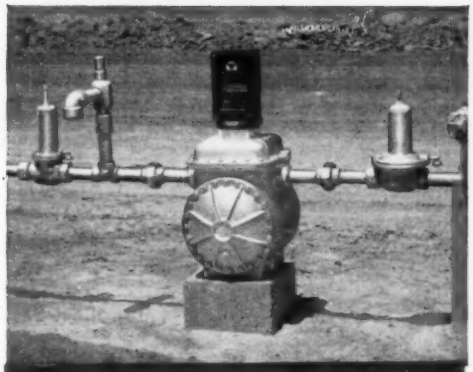

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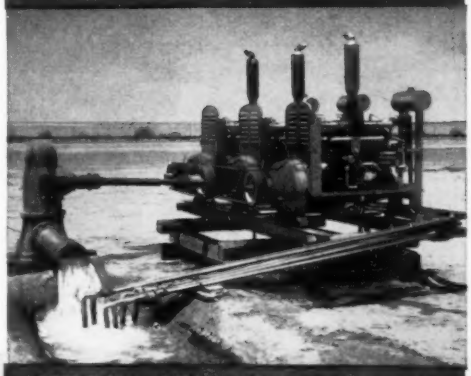

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GAS HIGHLIGHTS

Special from Neil Regeimbal, Washington

Field prices to Supreme Court

U. S. Supreme Court will review FPC's right to set field prices. Case is a challenge by Oklahoma Natural Gas Co. of FPC's approval of NGPL Co. of America's proposal to buy additional gas in Oklahoma and Texas to serve Chicago area.

Natural Gas Pipe proposed to buy gas from three I.P.'s at 13.9 cents per Mcf. An FPC examiner approved facilities needed, but said the price should be reduced. Full commission okayed the project without any price cut.

Oklahoma Natural and others claim the approved price is higher than an 11.0-cent price prevailing in the area and will up price to other buyers. The appeal, which the high court will look into, contends that FPC—under Natural Gas Act—must find all new rates "reasonable" as in revision of old rates. An appeals Court upheld FPC earlier.

Distribution systems in Canada get gas

Finishing touches on distribution systems through the Canadian Shield section of the Trans-Canada pipeline have been made by Northern Ontario Natural Gas Co. The last of some 30 cities from Kenora to Orilla were expected to have natural gas as we go to press. Northern Ontario invested $15 million this summer for the distribution systems.

Distributor's underground storage grows

Northern Illinois Gas Co. (Bellwood) is injecting about 4 MMcf daily in its Troy Grove project. More than 315 MMcf is in place in the sandstone reservoir. But, it will take time to determine whether to fully develop the storage field.

More gas for California

Pacific Lighting System companies (SoCal & SoCounties, Los Angeles) have filed with California PUC to construct the fifth pipeline to bring out-of-state natural gas to the Los Angeles basin. Currently in operation, two parallel lines from Blythe and one from Needles. Pacific Lighting Gas Supply has PUC permit to build another from near Needles which may move gas from Transwestern's proposed project. The new application plans to pick up gas from El Paso's proposed Thistle (near Provo, Utah) project at the California-Nevada border southwest of Las Vegas. It'll be 34-in. for the 200-miles; cost—over $44 million.

Colorado Interstate has filed with FPC for a $91-million Utah project to tie-in with the El Paso (and Pacific Northwest) Thistle project to bolster gas deliveries to California. This will reverse flow in CI's Wyoming system to sell El Paso 200 MMcfd near Green River, Wyo. They will build from Green River to Thistle, as well as 109 miles of 26-in., 136 miles of 34-in., and 107 miles of 30-in. from the Texas Panhandle to Denver.

Recent developments in Canada are felt to lend impetus to these plans.

"Methane Pioneer" to lay down liquid natural gas in England

The first experimental shipment of liquefied natural gas from near Lake Charles, La., to Canvey Island, Essex, England, is expected during early January. The test ship is "Methane Pioneer," a relatively small dry-cargo ship converted to a specialized tanker by Constock International Methane Ltd. (Continental Oil Co. and Chicago Stockyards Co.), and the British Gas Council. About 33,000 bbl of methane will be held in liquid state at 2 psig and minus 250 degrees F. The British will not use straight natural—sea movement too risky in case of war. It will be mixed with coal and by-product gases before distribution in the London area. This experimental program is expected to develop into a major project involving huge tankers if the technology and operation prove out.

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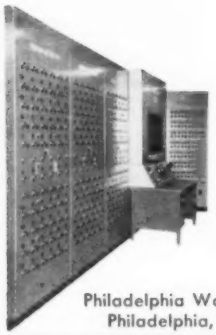

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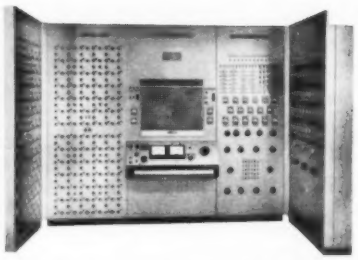

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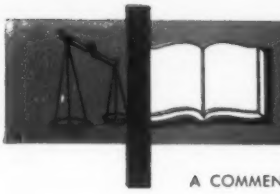


Regulatory and Legislative Trends

A COMMENTARY ON NATIONAL AND STATE DEVELOPMENTS BY AN EXPERT IN UTILITY LAW

Rapid tax depreciation really optional

MANY officials of utilities have shuddered when rate case opponents have advocated compulsory tax reductions and then concurrent customer rate decreases. A court decision rejected such compulsion. Under the 1954 Internal Revenue Code a taxpayer may elect to use accelerated depreciation for computing taxes rather than the customary straight-line method of equal annual amounts over the service life of the property. By using rapid tax depreciation the deductions are higher and the Federal income taxes are lower in the early years of the life cycle, but the reverse is true in the later years. Only the timing of the depreciation deductions is changed, because an asset can be depreciated no more than 100 per cent under any method.

Tax saving or deferral

There are "tax saving" theorists, however, who claim that the current temporary reduction in income taxes is a saving which should be passed on to ratepayers in lower prices for utility service. They even contend that for a growing company the tax saving will be permanent. The realistic school of thought considers that taxes are deferred and that a reserve should account for the tax differential resulting from accelerated depreciation compared with normal depreciation. These managers provide a reserve to meet the postponed tax liability and invest the tax deferral funds in utility property. That implements the intent of Congress, which was to make interest-free tax deferrals available for construction to stimulate the national economy.

Discretion of management

A recent Pennsylvania Court decision will gladden the hearts of management. The Court ruled that management cannot be compelled to take accelerated tax depreciation and then to pass the benefits on to ratepayers. It is comforting to know that courts will not permit the regulatory commissions to become the financial managers of utilities. Years ago the United States Supreme Court announced the rule that, "It must never be forgotten that while the State may regulate, with a view to enforcing reasonable rates and charges, it is not the owner of the property of public utility companies, and is not clothed with the general power of management incident to ownership."

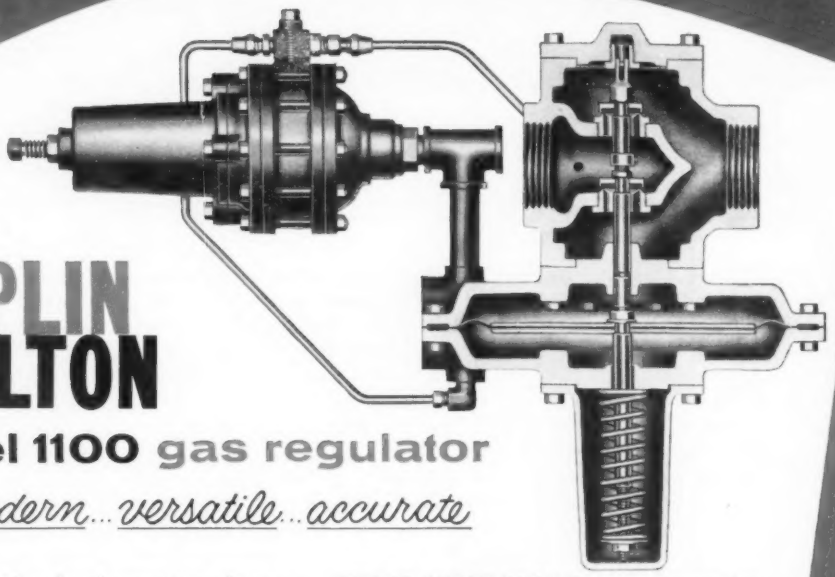
Customers pay for service

The "flow-through" school contends that utilities should be forced to make economies, such as those available from using accelerated tax depreciation, and flow all of the benefits through to ratepayers. To have utility rates based on normalized taxes where a utility uses an accelerated depreciation basis means that customers pay for more taxes than the utility actually pays, assert the "flow-through" theorists. They leap to the conclusion that ratepayers are required to contribute capital to the utility under those conditions. The transaction is really between the Bureau of Internal Revenue and the taxpayer. The United States Supreme Court long ago discarded that "capital contribution" idea. The highest court declared: "Customers pay for service, not for the property used to render it. Their payments are not contributions to depreciation or other operating expenses or to capital of the company. By paying bills for service they do not acquire any interest, legal or equitable, in the property used for their convenience or in the funds of the company. Property paid for out of moneys received for services belongs to the company just as does that purchased out of proceeds of its bonds and stock."

Pennsylvania court's ruling

In honoring the discretionary power of utility management, the seven-judge Pennsylvania Court made several enlightening observations. It is established in this Commonwealth that one of the costs of the service rendered by a utility is the actual income tax paid to the Federal Government, declared the Court. The decision to use any permissible method of determining depreciation in filing the federal income tax return and computing the tax is for the management of the utility. Management may properly exercise its judgment after consideration of the respective advantages or risks inherent in the use of any of the methods. In the prior proceeding this Court specifically stated: "The utility is not prohibited from using any of the methods set forth in section 167 of the 1954 Code; that is a matter between the taxpayer and the Federal Government. Actually the discretion to use or not to use accelerated depreciation under the 1954 Code is solely with the utility as a taxpayer. The Pennsylvania Public Utility Commission, however, does exercise control over the amount which it will allow the utility for taxes for rate purposes the same as it does over any other annual allowance for expenses. Here the commission has properly allowed the federal income taxes based upon the actual taxes paid."

Continued on page 91



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You can't buy, beg, borrow or steal a more versatile pressure regulator than MODEL 1100. Nor has traditional Chaplin-Fulton ruggedness, simplicity or accuracy been forgotten in this new modern design. Size —2" only, screwed, flanged 125 or 250 ASA.

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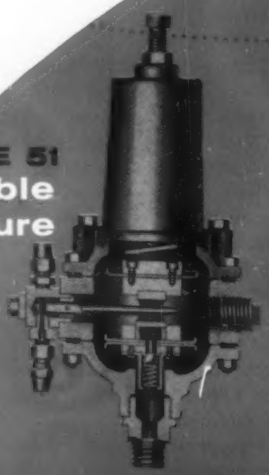


TYPE 51 variable pressure pilot

The heart of the MODEL 1100 assembly, insuring precisely accurate control over the complete flow range.

- Unitized construction—valve lever and orifice as a unit are removed from the outside, without disturbing balance of assembly. The likely trouble spot—the orifice—is placed outside where you can get at it quickly—no internal tubes to clog.
- Twin diaphragms remove as a unit.
- Internal relief unit—guards against overpressure.
- Spring unit—remove three screws to change springs.
- Built for service.
- Used for accuracy.

TECHNICAL TRENDS

By GUY CORFIELD

Underwater television

Closed circuit TV is now used for a great variety of purposes in industry, commerce, education and sports. Perhaps the most unique development is an underwater assembly that can be operated at depths down to 1000 ft where the pressure is about 450 psi. This system is applicable to offshore oil well drilling, to observe the progress, completion and maintenance of "ocean-floor" wells. This new ocean-floor method of offshore operation, with wells drilled from floating barges or ships, offers many advantages. It eliminates expensive permanent or semi-permanent "islands" or platforms; holes can be drilled straight down from several positions, which is cheaper than drilling several directional holes from one fixed location; and completion of the wells on the ocean floor will avoid permanent surface obstruction and danger from storms or collisions.

The TV camera is in a watertight pressure-tested housing, with indicating detector to warn the operator if a moisture leak develops. The camera's field is illuminated by externally mounted flood lights. Motors within the housing focus and adjust the camera lens. Hydraulic means are provided for rotating the entire assembly 300° and tilting it 45°. All controls, and the monitoring unit, are remote and above water, and can be at any location desired. The complete assembly, which is built to order for each application but consists of standard essential items, is called the Medearis Underwater TV. It has been developed by the Medearis Oilwell Supply Corp. of Torrance, Calif.

Ceramic coatings

Ceramic coatings for metals have been used for a great many years, but they are still being researched and improved, and promise more and more usefulness. Ideally they are heat, corrosion and abrasion resistant, able to withstand thermal shock, able to form a firm bond with the base metal, easy to apply, and inexpensive. Their applications are almost infinite. Their interest to the gas industry is in appliances and cooking vessels and kitchen furnishings—both for sections and parts in direct contact with flame and hot combustion products and hot liquids, and for utility and ornamental working surfaces and enclosures.

At the upper end of the temperature scale, ceramics that will withstand up to 5000°F (for missiles and rockets) are being sought. An aluminum oxide coating is said to be serviceable at 3600°F. At the lower end, 500°F heat resistance is combined with special properties such as flexibility, high electrical resistance, etc.

There are three general ways in which ceramic coatings are applied: dip coating, slurry spray and flame spray. Dip coating is used for applying porcelain, and for the "cermets" which are combinations of metallic powders and refractory materials with a bonding agent. In slurry spraying, the material in a thick liquid form with water or an organic vehicle, is sprayed on to the surface and then oven cured at temperatures up to 1600°F. Flame-spray ceramics are fed into an oxy-acetylene flame in rod form and deposited on to the surface to be protected. Aluminum oxide, zirconium silicate, silicon carbide, tungsten carbide and chromium oxide have been used. It is claimed that these flame-sprayed materials can be deposited in finished form so that the metal is not heated above 400°F. Therefore, the metal does not lose any "temper," or carburized or other heat treat properties that may have been given to it before coating.

Helium receiving increasing attention

A Technical Trend dated August 1958 entitled "Helium in Natural Gas" mentioned briefly the increasing usefulness of helium, and the concern over its loss in natural gas streams from which it is not being removed. It also mentioned the proposed Bell Laboratories process whereby it can be removed from natural gas or, for that matter, from any other gas or mixture of gases, by selective diffusion through glass. It was suggested that the glass could be in the form of "windows" in pressure vessels or even in the pipelines themselves.

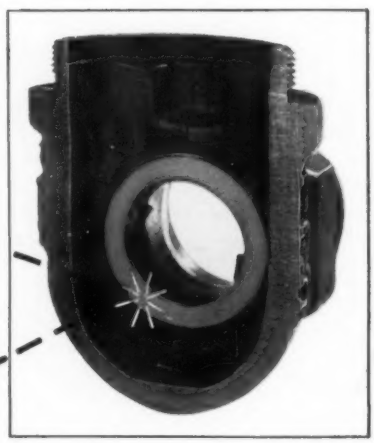
Nothing of a practical nature seems to have developed on the Bell process so far. It has been announced, however, that the U. S. Bureau of Mines, the sole agency in this country for the production and sale of helium, will build a $12 million plant for extraction from the natural gas from the Keyes, Okla., area. This will assertedly increase total U. S. production, in 1960, from the present 360 MMcf per year to 600 MMcf per year. The price of helium will be raised slightly to amortize the cost of this plant. Currently prices are $15.50 per Mcf in tank car lots to federal agencies, and $19 to non-government customers.

Another item of interest is the operation, by the General Electric laboratories, of what is said to be the largest and fastest helium wind tunnel in the world. This tunnel is for study of the problems of very-high-speed flight, such as necessary for a satellite or space ship to escape the earth's gravitational pull.

The tunnel has developed velocities of 28 times the speed of sound (about 17,000 mph). At this velocity, air breaks down into a variety of elements, compounds, ions, etc., and also tends to liquefy as it passes through small openings, and shock waves. Helium, however, is very stable and has extremely low liquefaction temperature, and is therefore the most effective gas for such work. The helium is discharged from cylinders, through a nozzle into the evacuated tunnel. Sections of the tunnel can vary from 3.6- to 6-in. diameter, and test models can be as large as 1-in. diameter.

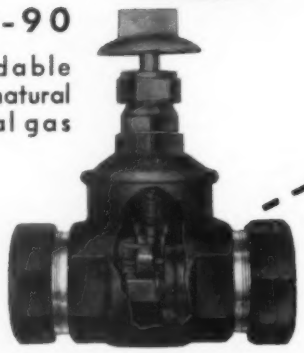
THESE PRECISION-GROUND SURFACES ASSURE

A PERFECT SEAL WITHOUT LUBRICATION!



LIST G-90

For dependable control of natural or artificial gas lines.



Iron body valve, bronze mounted, with mirror-finished gate and seat. Dresser couplings for use with steel pipe permit quick, simple installation without special tools and are unaffected by temperature changes, ground vibrations or tremors. *Above: 2-inch valve, showing Dresser coupling assembly and internal wedge and gate mechanism.*

Held tightly by the patented closing wedge, the mirror-finished gate and seat surfaces of the List G-90 valve are precision-ground to provide the perfect, cohesive seal. Absolutely *no lubricant necessary . . . ever!*

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VALVES AND HYDRANTS

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WASHINGTON

By NEIL REGEIMBAL
GAS Washington Bureau

Is Canada 'maturing' too rapidly?

CANADA, a youngster in the natural resources control field, is rapidly heading toward a "maturity" of the sort that is now causing most of the trouble in this country.

Good or bad, the Maple Leafers are heading down the road of cumbersome, super-legalistic delaying central regulations of gas, oil, and other natural resources which has unquestionably slowed development and cost the U. S. consumer millions of dollars in taxes and in expenses by utilities.

The trend was obvious some time ago. The lastest, and most positive manifestation was the recent interim report of the Royal (so-called Borden) Commission on Energy Resources. It could almost have been drafted by some of this country's erstwhile federal planners.

If the recommendations are followed, they will undoubtedly mean the end to the free-wheeling speculation and verbal contract that has thus far marked the tremendous growth of Canadian resources, particularly gas and oil.

On the Midwestern - Tennessee project, the commission specifically recommended that the original promise made by an earlier government to approve an export permit "must be considered no longer in effect," and that any application from Trans-Canada in the future would have to be considered on its merits.

This was a moot point, since the Diefenbaker government had made clear it did not consider itself bound by the promise of a government it had soundly beaten at the polls.

But the commission went further, and in effect chilled the chances of any early export license for Midwestern. Thus, even should Midwestern win the expected court battles over the FPC action in the case, another long fight seems likely in Canada.

The commission notes that gas covered by Trans-Canada's Alberta permit (4,350,000 MMcf) has been committed to fulfill sales agreements to purchasers in Canada. In addition, to meet known requirements in Canada, the firm will have to secure at least an additional 1.00 Mcf, it adds.

Thus, until Trans-Canada obtains a further permit from Alberta for gas surplus to the "reasonably foreseeable Canadian requirements, it will not be in a position to export any gas to Midwestern," the commission said.

Because of this shortage of contract gas for Canadian demand, the commission flatly recommends that action to permit export to Midwestern "should not be taken."

The effect of long delay in FPC consideration of the Midwestern case is noted by the commission, which points out that when the original Canadian promise was made, requirements for gas in Canada were considerably lower. "Had an import permit been granted by the Federal Power Commission . . . at sometime during the intervening three years, it may well have been that Trans-Canada would have been in a position to supply the gas," the report says, adding that "such is not presently the situation."

The commission, however, estimated total reserves at some 300 trillion cu ft in western Canada, and noted that there will probably be "moderately increasing volume of gas in excess of Canadian requirements available for export." It also noted that much of the western gas economically is better suited to export to the West coast of the U. S., and says that export to this country, "on a moderate scale, is a highly desirable step."

On the question of Westcoast Transmission Co. Ltd. exports to this country, the commission demanded that firm regulations be imposed by the Board of Transport commissioners to ensure that profits and contracts do not "result in Canadian consumers of natural gas contributing more than their fair, reasonable and proportionate share of the total return" or investment.

The commission notes that an independent survey it ordered found that if costs of service were allocated, "the operating profits of Westcoast were coming solely from the Canadian consumer and no profit was being made by Westcoast in carrying out the terms of its contract with Pacific Northwest."

It also says that differing evidence was later submitted, and recommended that the Board of Transport commissioners study the question further, particularly in considering a pending application for additional exports.

The commission demands that

strict price control over pipelines be started and recommends an FPC-type certificate of public convenience and necessity be required for anyone wanting to transport or process gas. It would also grant control over conservation, end use, and all other matters concerned with all fuels and energy, to the proposed new energy board.

One recommendation certain to raise a controversy in Canada is that the new energy board be completely free from control of any of the present cabinet ministers. This is a sharp departure from usual Canadian spoils system procedure, and will be bitterly fought, Canadian experts say.

As the general conditions which should govern granting of an export permit, the Borden Commission recommended the following:

Present and anticipated requirements of gas in Canada.

Advisability of encouraging the development in Canada of processing industries relating to energy and sources of energy for the construction of pipelines within Canada.

Economic feasibility of the proposed project and whether it is "in the national interest."

Financial structure of the applicant company, with particular attention to the opportunities presented to Canadians to participate in its financing and construction program.

There is more than a hint of strong nationalism in the report. More than one of the recommended general standards are the outgrowth of bitter sentiment among some Canadians that U. S. "robber barons" have made fantastic speculative profits out of Canadian development projects while milking the country of both money and natural resources.

Effect of the commission recommendation on Midwestern was two-fold. Initially, it came just as the Federal Power Commission was winding up two years of study of the Midwestern project, which involves shipment of 204 MMcf a day from the U. S. Gulf Coast to Chicago, and an equal amount of Canadian gas from the Minnesota-Canada border south.

In addition, it could mean a second major delay—and possibly the eventual death by delay—of the entire project. The Diefenbaker government has two alternatives: Grant or deny a temporary export certificate on the merits of the sale, or follow the Borden Commission recommendations to establish a regulatory commission with Federal Power Commission-type procedures, and let this new group consider the entire question.

This would be no quick and easy consideration, if the Borden Commission recommendations were followed. The commission urged that a national energy board, of three or five members, with power to grant, revoke or suspend export licenses and control inter-provincial shipments be set up. It would also make reports and recommendations on energy control, inventory resources, and hold hearings.

But the power to regulate prices, tolls and tariffs of gas and oil pipeline companies would be left with the Board of Transport, which would make a complete restudy of all existing prices every two years.

Thus a firm would have to get an export license from the new board, and then go before the transport board for approval of rates and conditions.

The only direct recommendation on the Trans-Canada-Midwestern problem was a notation by the commission that "no special measures need be taken in relation to (Trans-Canada) in order to safeguard the interests of Canadian producers or consumers of gas."

This too meant little in the controversy, since there was no pending export license, or even a formal application for an export license.

As factions on both sides of the political center line busily count their gains and losses from the November elections, gas bill advocates are trying to figure out what type of new gas bill stands a chance of passing next year.

The outlook is dim. The so-called conservative element in Congress is licking bloody wounds. With their numbers again reduced far more than the simple Democratic-Republican vote tally shows, the gas bill supporters too suffered a major defeat.

Because of the elections, the annual sessions to draft gas legislation (or amend previously beaten bills) got underway late this year. There's a good chance, according to some insiders, that all the necessary preliminaries (lining up support in and out of Congress and drafting the compromises) won't be finished for some months. This would mean the bill won't be ready for introduction until around the middle of the congressional session.

This in itself might hurt the bill's chances. It usually takes lots of time to work such controversial legislation through the congressional mill.

There's another factor working against the bill too. Most pundits don't believe Congress will get down to any serious legislation until about Easter in this off-election year. There'll be some investigations and lots of talk to fill up the first third or so of the session.

About the time Congress convenes early in January, the gas industry will find out what, if anything, will be pushed on Capitol Hill to straighten out the future of pipeline rate increases.

Gas industry legal eagles figure that the U. S. Supreme Court will rule on the Memphis case sometime in December or early January.

Most betting gives odds that the high tribunal will create as many new problems as it solves. These bettors don't figure the Court will give a simple yes or no ruling on the question of whether a lower court was correct in preventing pipelines from using the short procedures of section 4 of the Natural Gas Act unless all customers agreed in advance.

Instead, they look for a complicated document which will attempt to set some specific answers, but probably will miss by a country mile in providing a clear solution.

Continued on page 90

Announcing Honeywell's new

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By MARSHALL E. PARKER

Climate and corrosion

IT is a well-recognized fact that atmospheric corrosion varies widely with variations in climate. The arid desert is far less corrosive than the humid and salt-laden seacoast; and for extremes, we may consider the virtually corrosion-free Antarctic and the virulently corrosive tropical jungle, where not only metals but almost all the creations of man are subject to swift destruction.

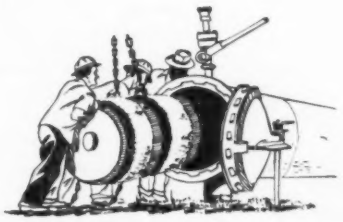
It is not so well known, but none the less true, that underground corrosion is also profoundly influenced by climate. This effect takes two recognizable forms; first, things that look alike may actually be quite different, due to climate variations; and secondly, climate may introduce a variation in the time scale.

An instance of the first form is the difference between swamp land and muskeg. Those whose experience has been accumulated in temperate climates are accustomed to thinking of low wet areas as being probably more corrosive than better drained soils. Both resistivity measurements and experience bear out this judgment, in general—in temperate climates. But in more northerly regions, muskeg areas, which appear swampy to the eye, are of high resistivity; and experience confirms that they are in fact only mildly corrosive. Even in temperate regions the same thing is true of bogs, which are little more than muskeg out of place, and not the same thing as swamps at all.

A more obvious effect, which nonetheless escapes the attention of many, is the effect on the corrosion rate or leak rate of frost in the ground at pipe depth. Corrosion, like most chemical or electrochemical reactions, is strongly influenced by temperature, and the effective rate at freezing temperatures is practically zero. Hence, in an area where there is frost at pipe depth one-half the time, the leak rate is reduced by about 50 per cent. Experience substantiates this observation; three corrosion engineers were shown a resistivity profile, actually taken in western Canada, with the implication that it referred to the Gulf Coast area. They were asked to predict the leak experience of bare lines in the soil; all three predicted something like "serious trouble in three to four years." The actual experience on the flow lines involved has been beginning troubles, not yet serious, in seven years. This corresponds very neatly to a frost period averaging about 175 days, or almost 50 per cent.

Corrosion Surveys

WHEN you engage the services of an engineering firm or of an individual consulting engineer for a corrosion survey, what should you get for your money? Too often what you do get depends on what other activities also occupy the particular firm or individual involved. Primarily, you are entitled to *all the field data taken;* anything less than this is a simple failure to deliver a commodity sold and paid for.

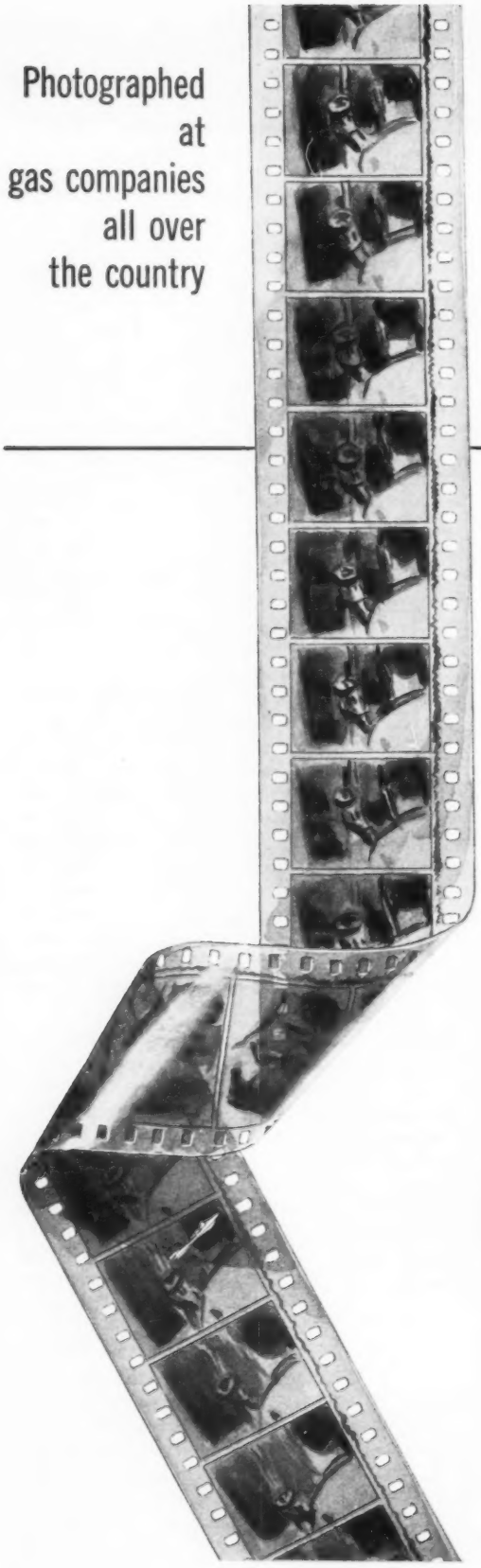


You should also get an understandable analysis of the data, and, if any recommendations are made, some calculations to support these recommendations. Both of these should be such that they can readily be followed by a competent corrosion engineer; they need not be totally intelligible to a layman, although a report which has this characteristic is better than one which does not.

The report may or may not include cost estimates for the recommended measures to be taken; if it does not include these, then it should be sufficiently complete that direct bids may be obtained for the recommended work. In any case, it should be so complete in its description of the recommended installation that the work could be performed without further communication with the engineer. Otherwise he simply has not done his job.

The most glaring deficiency in this respect is the report which merely says, in effect "you have a serious corrosion problem; it can be remedied, at a cost of $—; we will do this work for the sum mentioned." This is *not* an engineering report; it is a bid by a contractor, to perform certain work which he says is needed. In the best cases—and there are several of them doing business—the *only* deficiency is their failure to provide all the data: in the worst—and these, too, exist—there may be out-and-out fraud involved. In either case, the furnishing of all the field data makes it possible for the client to use his own, or other, engineering talent, to verify the findings, conclusions, and recommendations. ■

Photographed at gas companies all over the country



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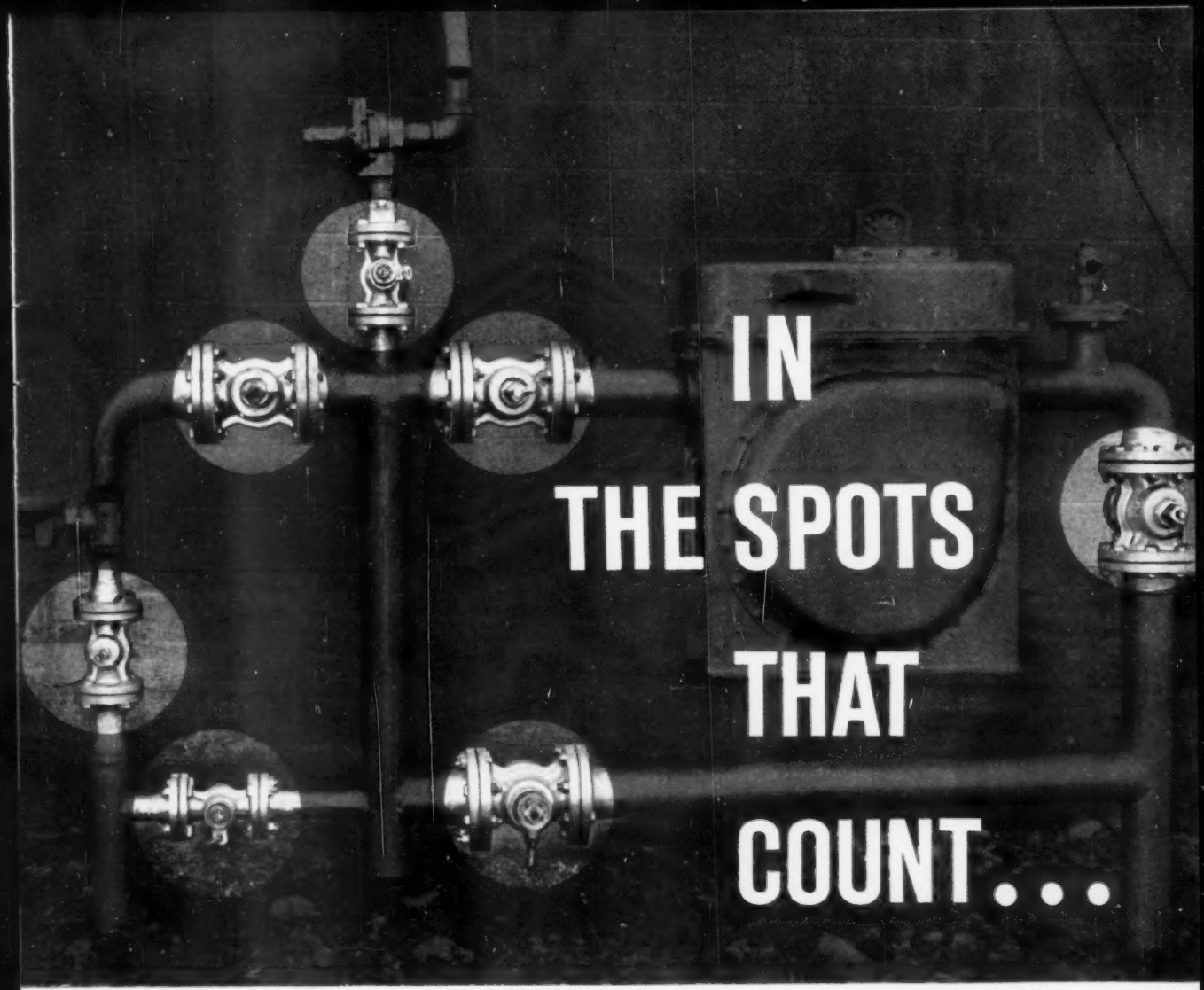

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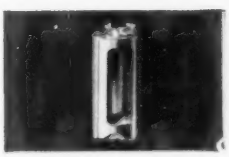

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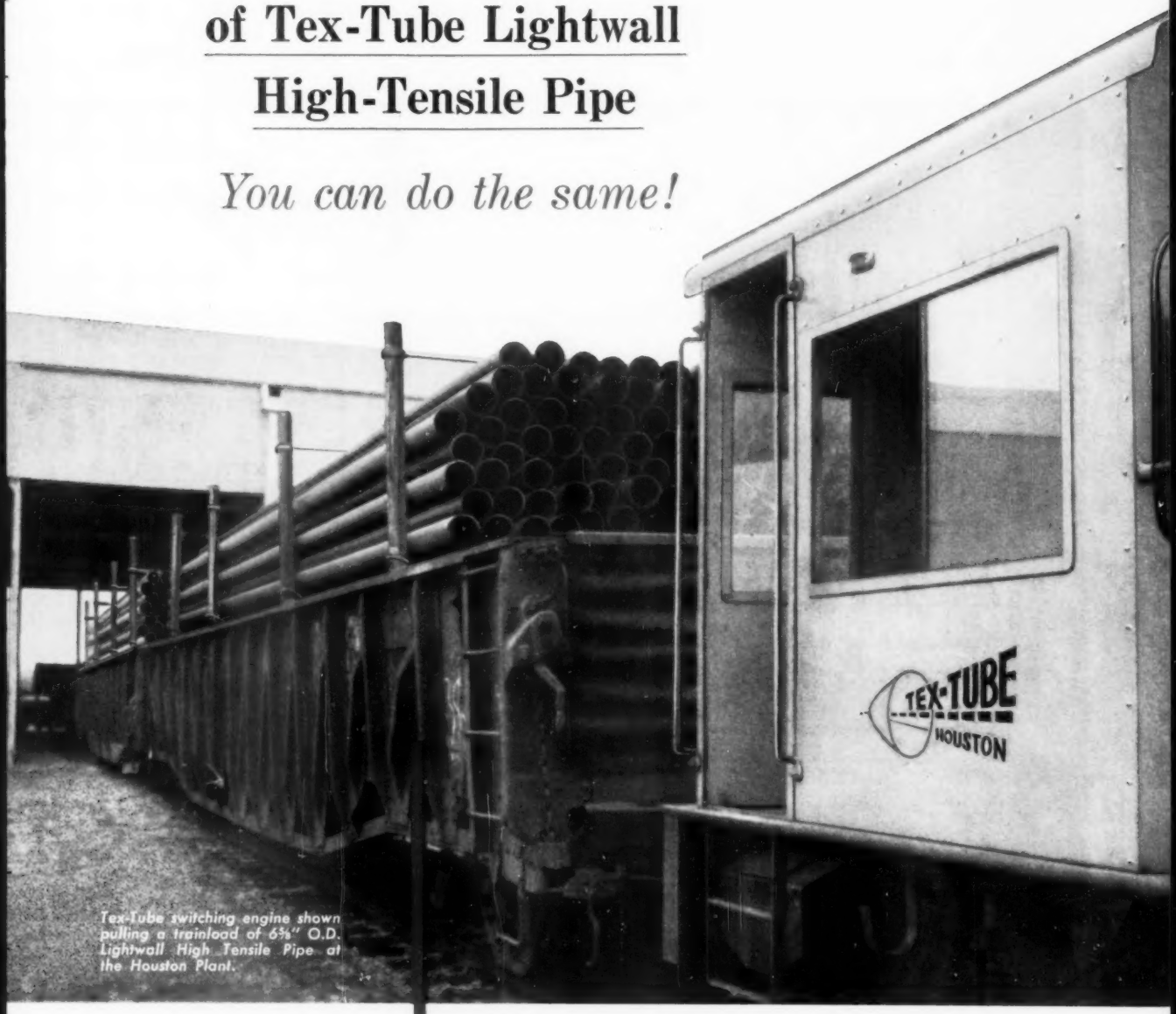

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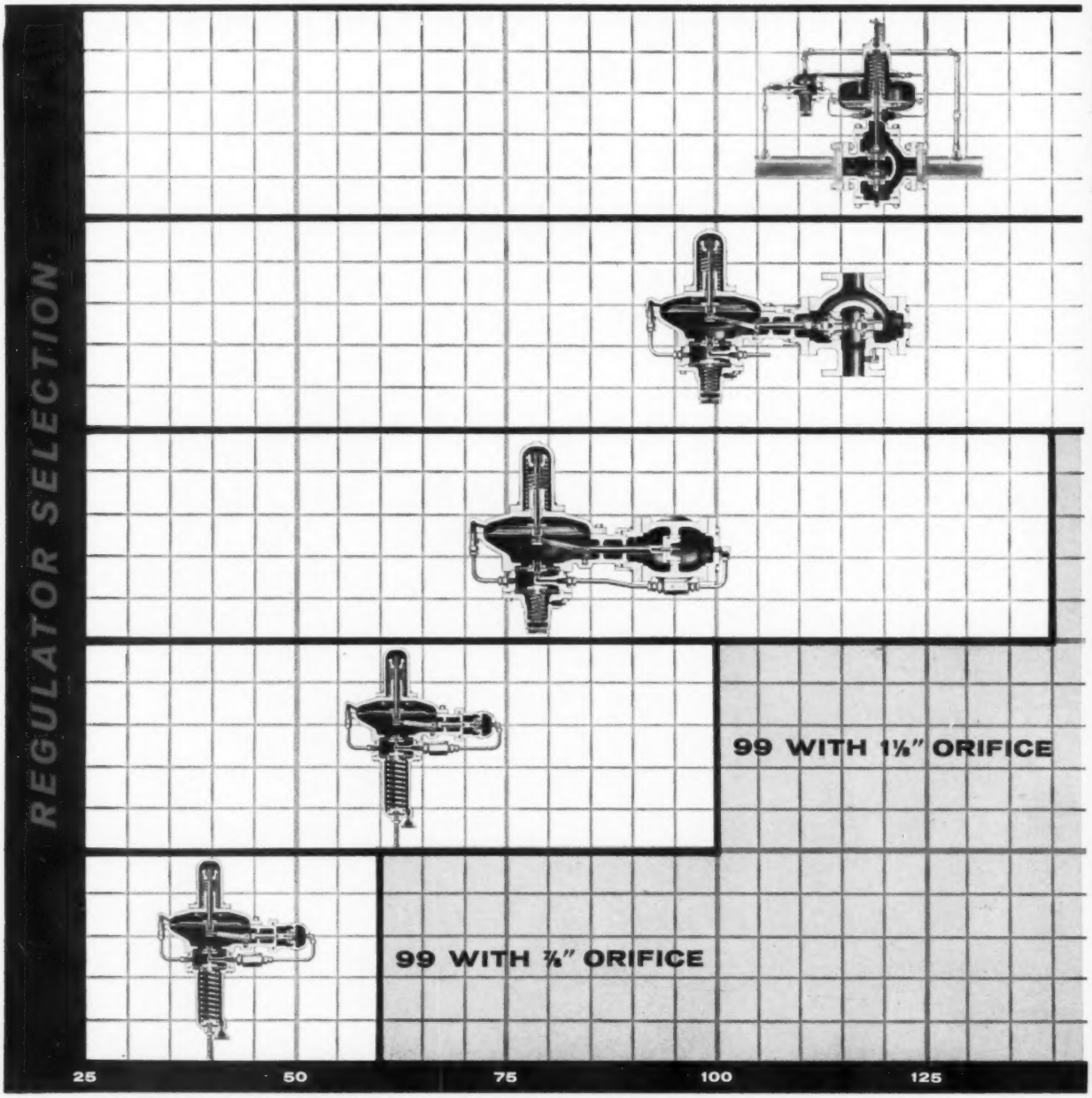
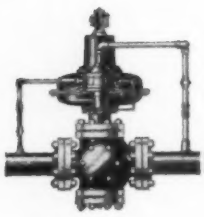
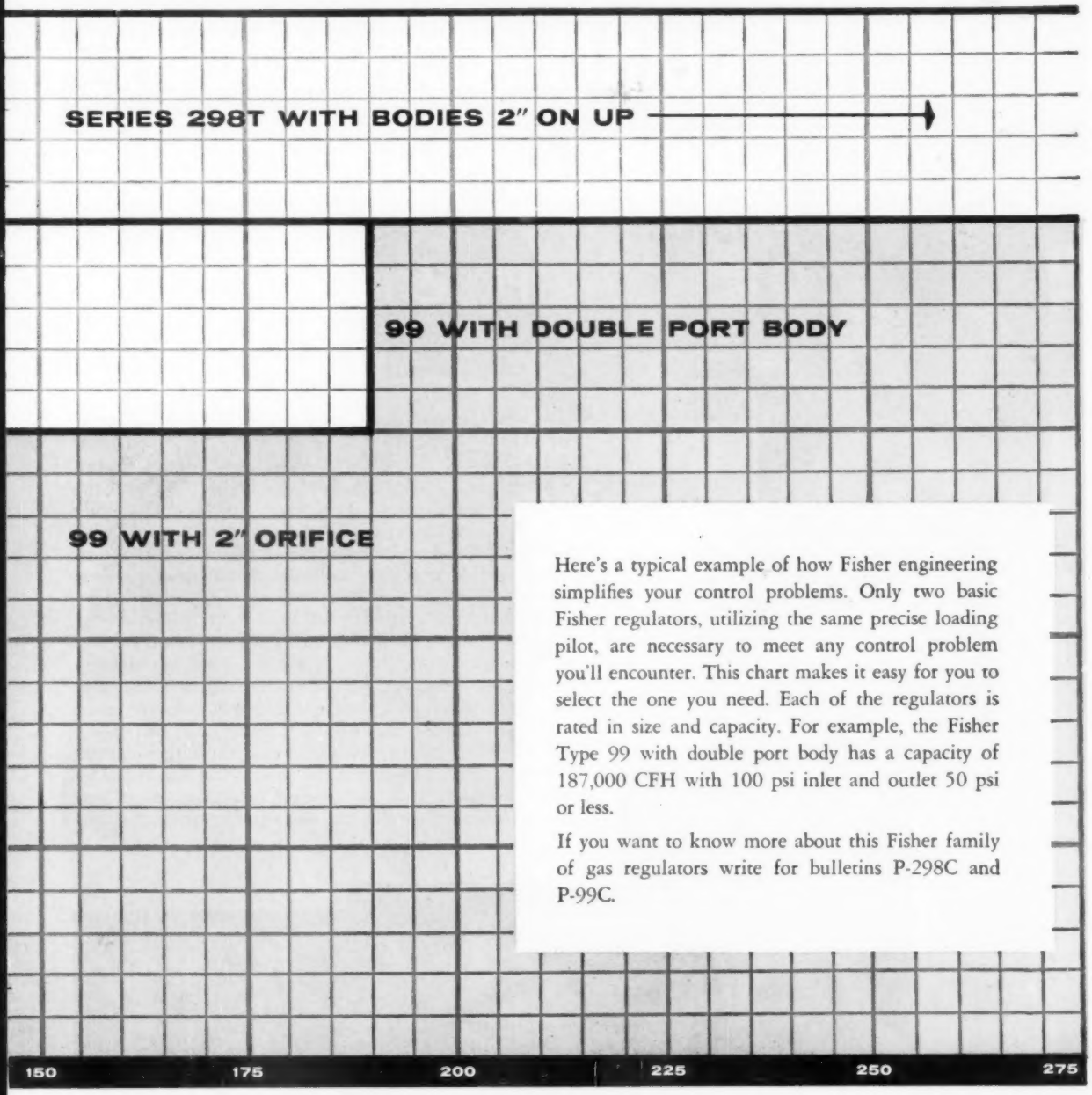


CAPACITY IN 1000 CFH—WITH 100 PSI INLET AND OUTLET 50 PSI OR LESS



IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

for your Distribution System



Here's a typical example of how Fisher engineering simplifies your control problems. Only two basic Fisher regulators, utilizing the same precise loading pilot, are necessary to meet any control problem you'll encounter. This chart makes it easy for you to select the one you need. Each of the regulators is rated in size and capacity. For example, the Fisher Type 99 with double port body has a capacity of 187,000 CFH with 100 psi inlet and outlet 50 psi or less.

If you want to know more about this Fisher family of gas regulators write for bulletins P-298C and P-99C.

FISHER® Controls

SINCE 1880

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

THE ANSWER TO CONNECTION PROBLEMS

BRANCH CONNECTIONS

MADE UNDER PRESSURE

The best and most economical method of making lateral or branch connections is to use Smith All Mechanical Joint Tapping Sleeves and Valves or Stopper Pieces. This method ELIMINATES GAS SHUT OFF and the permanent, leak-proof installation is achieved speedily by employing these simple procedures: 1. Block Sleeve Outlet Half under pipe, position side flange gaskets, bolt Sleeve halves together. 2. Position end joint gaskets; install follower rings, bolts and nuts. 3. Rotate Sleeve outlet flange to desired position, tighten follower ring nuts. 4. Tighten side flange gasket compression screws. 5. Attach Tapping Valve. The installation is complete and ready for tapping. 5. (Alternate) Stopper Pieces may be used in place of Valves when connections are made to low pressure mains and permanent shut off Valves are not needed; however, the use of Tapping Valves is recommended. The cost of the connection is reduced by quicker installation, elimination of skilled labor and costly jointing material. Bulletin will be sent on request.

51

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

Replace services without trenching

Tubing of Tenite Butyrate can be run through the metal pipe

Plastic tubing of Tenite Butyrate makes natural gas service replacements easier—and more economical. This tubing eliminates the need for trenching—the most expensive operation in service replacements. Only two holes need be dug: one near the gas main tap, the other at the service riser. Tubing of Tenite Butyrate is then run through the corroded metal service line. Since plastic creates less friction than metal due to the smoothness of its walls, pressure is unaffected by the slight decrease in diameter of the service line. Easy-to-use adaptors make connections between tubing and metal pipe.

Installation time is further cut because tubing of Tenite Butyrate is easy to handle. It is so light in weight that an average service of 70 feet weighs less than four pounds.

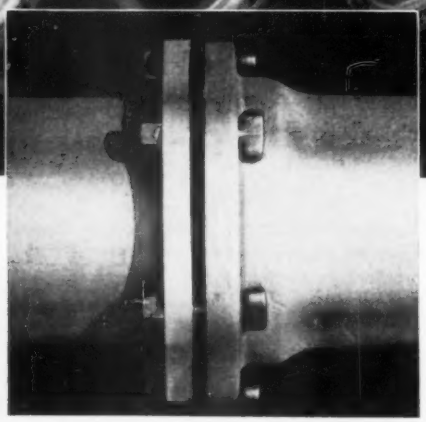
The economy does not stop with installation, however. Tubing made of Tenite Butyrate withstands soil corrosion or electrolysis—so you are assured of many years of trouble-free service.

Since 1943, extensive field use has demonstrated the many advantages of Tenite Butyrate over metal for natural gas service. One company has already installed nearly 3,000,000 feet of Butyrate tubing—for both new and replacement service lines.

Discover how you can share in the benefits offered by this Eastman plastic. At your request we'll send more information about the tubing, fittings, and their installation, plus a list of suppliers in your area who handle tubing made of Tenite Butyrate. Write: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

A 16mm. sound-color film, "Plastic Pipelines," is available upon request.

TENITE
BUTYRATE
an Eastman plastic



12" Mechanical Joint Cast Iron Pipe
for gas main in New Jersey.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe,
Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

MECHANICAL JOINT cast iron

cast iron... the pipe with 'built-in' insurance

its dependability is proved... not promised

With cast iron pipe you get more than metal. Every length carries with it the definite, if unwritten, promise of dependability and long life.

The record proves it. Cast iron gas mains installed by 57 American gas companies over a century ago are still serving. Mains with fifty and more years of service are common. Best of all, *modern* cast iron pipe, centrifugally cast, is even tougher and stronger.

Specify cast iron and be sure. Your mains will, literally, "wear like iron."

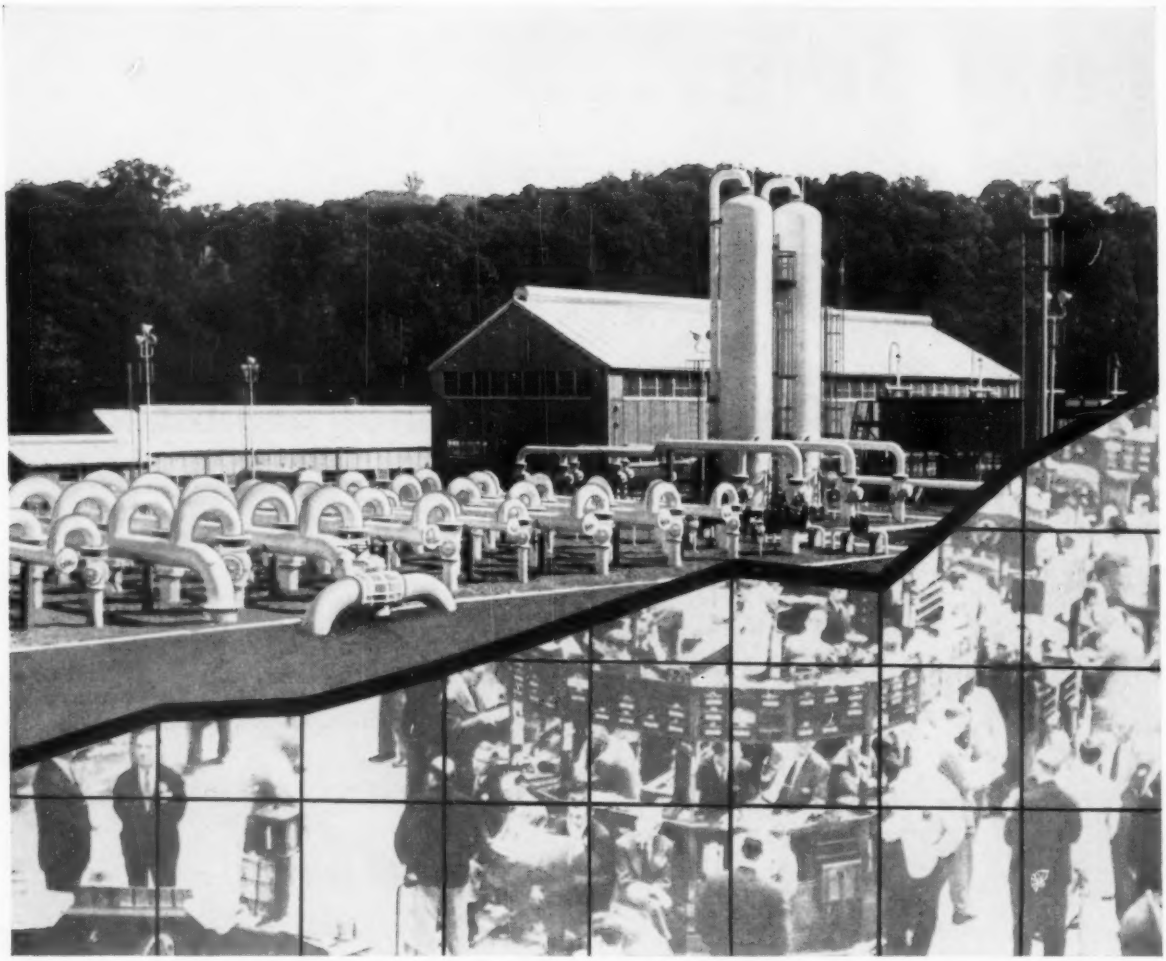
A FEW OF THE 57 GAS UTILITIES WITH CENTURY-OLD CAST IRON MAINS IN SERVICE

Peoples Gas Light & Coke Company, Chicago—Cincinnati Gas & Electric Co., Cincinnati – Michigan Consolidated Gas Co., Detroit – Elizabethtown Consolidated Gas Co., Elizabeth – Southern Indiana Gas & Electric Co., Evansville.

MODERN CAST IRON PIPE IS EVEN MORE EFFICIENT

- Centrifugally cast, it's tougher, stronger, more uniform.
- Standardized mechanical joints are bottle-tight under all gas distribution pressures . . . for all types of gas.
- Uniform wall thicknesses.
- Joint design allows deflection during and after installation.
- Service lengths and variety of standard fittings cut time and labor in congested undergrounds.

pipe FOR MODERN GAS DISTRIBUTION



Compressor station squeezes gas handling costs through Pritchard's GOOD FINANCIAL DESIGN

The Majorsville Compressor Station recently built by J. F. Pritchard & Co. is part of a double-barreled solution to the problem of meeting peak demands for gas in the Pittsburgh area. Manufacturer's Light and Heat Company uses the new 5280 HP station in two ways: 1) to make the most economical use of pipeline capacity and 2) to reduce storage costs.

During off-peak periods, the station injects pipeline gas into depleted West Virginia gas wells which now serve as underground storage tanks. In this way, the company is able to take full advantage of off-peak rates. In the winter, the station withdraws the stock-piled gas and pumps it to customers.

Through Pritchard's emphasis on good financial design, the Majorsville Station has replaced an older compressor station at a cost permitting a reasonable return on the investment.

Compressor stations have long been a Pritchard specialty. In the last two years, Pritchard has installed over 130,000 HP on some 28 different jobs. On many of these installations, Pritchard did the entire job—design, engineering and construction. Other Pritchard services for the gas industry include dehydration plants, gas conditioning and treating plants, LP gas storage systems and peak shaving plants.

Pritchard's know-how and experience . . . Pritchard's emphasis on good financial design . . . are at your service.

Regardless of the size of your next job—if it's in the gas industry—it will pay you to talk to Pritchard.

PROFITABLE FACILITIES THROUGH GOOD FINANCIAL DESIGN

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS

Dept. 414, 4625 Roanoke Parkway, Kansas City 12, Mo.

OFFICES IN CHICAGO, HOUSTON, PITTSBURGH, NEW YORK

SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

Made of malleable iron. Single massive bolt. All sizes, 1/2" to 12" inclusive. For steel, cast iron and Transite pipe.

M. B. SKINNER COMPANY

SOUTH BEND 21, INDIANA, U. S. A.

SKINNER-SEAL SERVICE SADDLE

MULTI JET The new

packaged LP-Gas Mixer

Low and High Pressure

for standby—peak shaving —100% service

This complete cabinet unit makes it practical for utilities of any size, regardless of pressure requirements, to insure their gas supply. Ready to cut in at a moment's notice, manually or automatically, the *Draketown* MULTI JET provides an interchangeable fuel for natural gas. Guarantees critical control and uniformity of Btu sendout and more flexible low-load operation. Requires very little maintenance.

An inquiry will show how simply you can get "gas insurance" at your plant. There is no obligation.

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HOLLAND 123533

DRAKE & TOWNSEND
INCORPORATED
11 West 42nd St., New York 36, N. Y.

The foremost producer of propane plants throughout the world

GAS CALENDAR

December

30- 5 . American Society of Mechanical Engineers Annual Meeting—Statler Hotel, New York.
7- 9 . Institute of Appliance Manufacturers Year-End Meeting—Statler-Hilton Hotel, Dallas.
30 . Rocky Mountain Gas Association Annual Meeting—Denver, Colo.

January **1959**

12-13 . Joint AGA-PCGA Public Relations Conference—Westward Ho Hotel, Phoenix, Ariz.
22 . New England Gas Association Operating Division—Hotel Statler, Boston.
29 . New England Gas Association Accounting Division, Hotel Statler, Boston.
29-31 . AGA Home Service Workshop—Jung Hotel, New Orleans.

March

2- 3 . AGA General Management Section Conference—Hotel Statler, Cleveland.
9-11 . Mid-West Gas Association Annual Meeting and Convention—Hotel Ft. Des Moines, Des Moines, Iowa.
16-20 . National Association of Corrosion Engineers—Sherman Hotel, Chicago.
19-20 . New England Gas Association Annual Meeting—Hotel Statler, Boston.
24-26 . PCGA Combined Residential & Non-Residential Sales & Advertising Conference—Sacramento, Calif.
26-27 . Oklahoma Utilities Association Convention—Mayo Hotel, Tulsa.

April

1- 3 . GAMA Annual Meeting—The American Hotel, Bal Harbour, Fla.
6- 9 . AGA Operating Section Distribution Conference—Netherland-Hilton Hotel, Cincinnati.
7- 9 . AGA Sales Conference on Industrial & Commercial Gas—Hotel Warwick, Philadelphia.
20-22 . AGA-EEI Accounting Section Conference of Electric & Gas Utility Accountants—Sherman Hotel, Chicago.
22-24 . Indiana Gas Association—French Lick-Sheraton Hotel, French Lick, Ind.
27-29 . Southern Gas Association Annual Convention—New Orleans.

May

11-12 . AGA Eastern Gas Sales Conference—The Netherland-Hilton Hotel, Cincinnati.
18-19 . AGA Operating Section Transmission Conference—Statler-Hilton Hotel, Dallas.
18-20 . AGA-Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.
19-21 . Pennsylvania Gas Association—Pocono Manor Inn, Pocono Manor, Pa.
21-22 . The Natural Gas & Petroleum Association of Canada—Hamilton, Ont.
25-27 . AGA Operating Section Production Conference—Hotel Sheraton, Rochester, N. Y.

The new Superior ALUMINUM CASE METERS

. . . the slow-motion meters you can rely on longer

This slow-motion, long-lived meter operates at only 7 revolutions per cubic foot to reduce wear and stay accurate longer. And its simple, horizontal seam construction gives fewer chances for leaks . . . makes maintenance quick and simple. Whether it's adjusting the tangent through the handy access in the top . . . removing the top to grind the valve seat . . . or lifting out the valve table with the entire inner movement to replace the diaphragm, simply loosening a few screws makes everything accessible.

Get full details. Send for bulletin 1150.

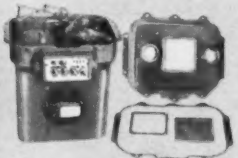
This modern meter exploits all the time-tested advances in meter technology *plus* the latest manufacturing techniques of Superior's new plant.

SUPERIOR METER COMPANY, INC.
19 West 50th Street, New York 20, N. Y.
A SUBSIDIARY OF NEPTUNE METER COMPANY

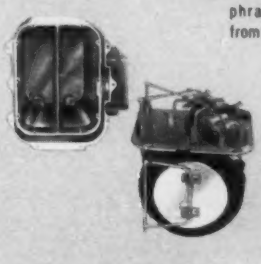
neptune

Look at these advanced design features:

1. Simple, horizontal seam . . . eliminates leakage . . . easier maintenance
2. Easily accessible table . . . just remove the screws holding top



3. Meter top removable without taking off index box
4. Valve seat readily accessible for grinding when top is removed
5. Slow movement; only 7 revolutions per cubic foot
6. Seam gasket stays resilient . . . cork and Buna-N composition
7. Valve table lifts out with entire mechanism



8. Heavy-duty, sintered bronze bearings oil-impregnated for life
9. Flag arrangement gives arm smoother operation and longer life
10. Accurately controlled diaphragm . . . no inaccuracies from deflection
11. Cupped handling lids permit easy and safe carrying
12. Handy access for tangent adjustment and calibration
13. Broad base for solid stacking . . . designed for conveyorized handling
14. Index removable without removing meter

In 250 cfh and 340 cfh sizes to meet most domestic requirements.

Barber-Greene Model 774 Wheel Ditcher with new, simple hydraulic controls gives you more ditch per day. Write for new bulletin.

New hydraulic ditcher controls give more ditch under all conditions

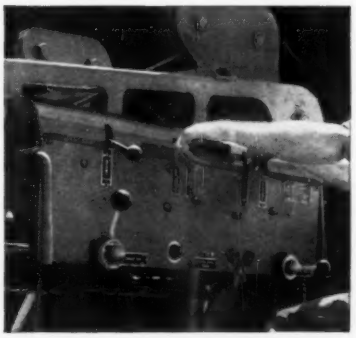
Simple hydraulic controls on the Barber-Greene Model 774 Wheel Ditcher and Model 784 Vertical Boom Ditcher give greatest accuracy, offer a new high in operating ease. The result is more ditch —and more profit—per day.

The entire control panel, with all controls within easy reach, results in less fatigue and greater comfort for the operator. Hydraulic brakes, controlled by convenient foot pedals, give easiest steering and greatly increased accuracy.

Exclusive Hydra-Crowd transmission allows instant selection of fastest crowding speed for every condition from infinite range available. Spoil conveyor speed infinitely variable, independent of wheel or bucket line and crowding speeds. All mechanical shifting in selecting speeds is eliminated. Electrically actuated overload release is set by simply turning a dial.

All these Barber-Greene Ditchers have advanced hydraulic controls:

Cross Country—Model 774 Wheel Ditcher, illustrated above.
City Work—Model 784 Vertical Boom Ditcher, convertible to wheel ditcher.
House Services—Model 705-B Runabout Ditcher, pneumatic tires.
New Mobility—Model 711 Inclined Boom Ditcher, truck-mounted.
Underground Cable—Model 702 Ditcher, Varidraulic transmission.



Operators learn to run these machines quickly and accurately . . . no complicated gear selections and fatiguing manual operations.

58-33-D

Write for literature on the ditcher line of advanced design.

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

PROTECTOMOTOR

STAYNEW FILTERS

DOLLINGER

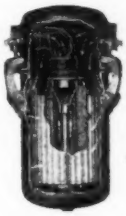
ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Dollinger makes ALL TYPES of filters as shown on this page, plus special filters for unusual filtration problems. New users of one specific type of Staynew filters often find a second Dollinger filter performs a great, added service in other processes or operations. Dollinger maintains complete engineering, design and laboratory facilities for the development of special filters for new and unusual applications.

Write for complete information on any of the Staynew filters illustrated. Be sure to specify Bulletin Number or Numbers. Consult Dollinger Engineers on any special filtration problems—no obligation. Dollinger Corporation, 68 Centre Park, Rochester 3, N.Y.

PIPE LINE FILTERS

Model CPH
Pipe Line Filter
Bulletin 200



Model CVH (Vacuum)
Pipe Line Filter
Bulletin 200

Model AAPHS
(Absorption)
Pipe Line Filter
Bulletin 200

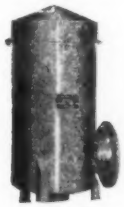
Model HPH and AHPH
(High Pressure)
Pipe Line Filter
Bulletin 200

LIQUID FILTERS

Model HE (Sump)
Liquid Filter
Bulletin 330

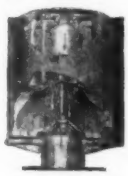
Model ELS (Pressure)
Liquid Filter
Bulletin 300

AIR INTAKE FILTERS



Model iDR
(Ground Level)
Air Intake Filter
Bulletin 100

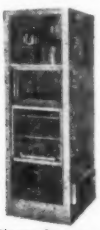
Model DS (Silencer)
Air Intake Filter
Bulletin 100



Model D (Outdoor)
Air Intake Filter
Bulletin 100

Model C (Indoor)
Air Intake Filter
Bulletin 100

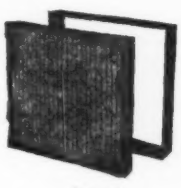
VENTILATION FILTERS



Electro-Staynew
Mist Collector
Bulletin 420

Electro-Staynew
Precipitator
Bulletin 400

Automatic
Ventilation Filter
Bulletin 500



Dry and
Viscous Panel
Ventilation Filters
Bulletin 600 and 700

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CLARK BROS. CO.
compressors and gas turbines

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advanced scientific research

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steel structures

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DRESSER MANUFACTURING
DIVISION—couplings

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THE GUIBERSON CORPORATION
oil tools

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HERMETIC SEAL TRANSFORMER CO.
electronic transformer development

IDECO Inc.

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drilling rigs

GREETINGS . . .

Peace on Earth to Oilmen Everywhere in an industry that is just completing its first century of service to mankind in making the world a better place to live, love and work.

MERRY CHRISTMAS

LANE-WELLS COMPANY
technical oilfield services

MAGNET COVE BARIUM CORP.
drilling mud

PACIFIC PUMPS, INC.
pumps

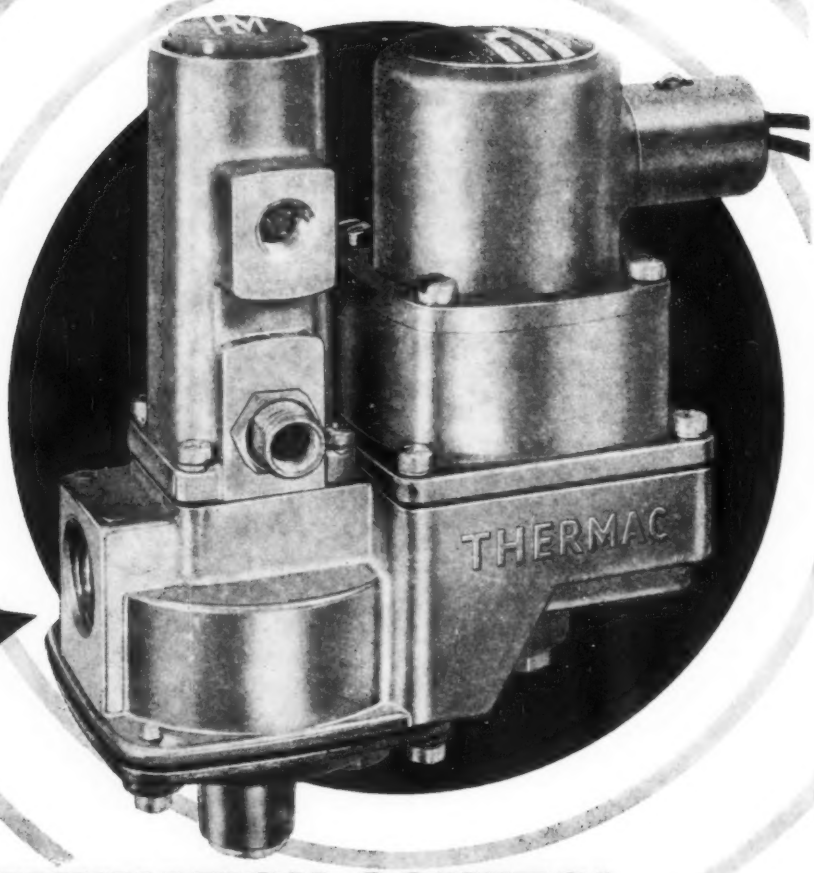
ROOTS-CONNERSVILLE
BLOWER DIVISION
blowers and meters

SECURITY ENGINEERING
DIVISION—drilling bits

SOUTHWESTERN INDUSTRIAL
ELECTRONICS
electronic instrumentation

WELL SURVEYS, INC.
nuclear and electronic research

For the Mass Market in the Heating Field!



THERMAC Model SLS-121
Unit illustrated has
100% pilot shut off.

COMBINATION CONTROL

REGULATOR • SAFETY • AUTOMATIC MAIN GAS CONTROL VALVE

Safe Lighting With or Without 100% Shut off.

Certified by A.G.A.

In a carefully calculated design based on 25 years gas control experience, THERMAC combines in this three-in-one control every feature important to the appliance builder, the dealer, and the customer. Identical in performance and capacity to the now universally accepted SLS-100, it is ideal where space below the control is limited. The unit consists of a regulator, quiet automatic main gas valve and a 100% pilot shut off when required. A manual reset is available in conjunction with automatic main gas valve. Every component is long proven and well accepted in the gas appliance field.

Drawings, prices and samples of the SLS-120 series are now ready for manufacturers interested in reducing the over-all cost of gas control assemblies.

Write, wire or telephone for immediate action.

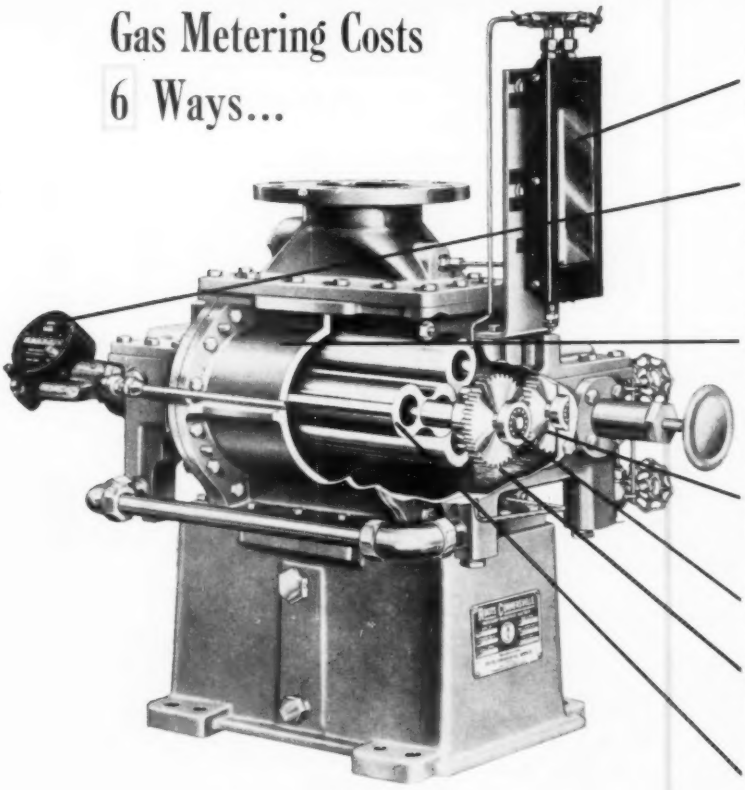
THERMAC

HM COMPANY

14296 East Sixth Street,
Corona, California. REdwood 7-3511

Distributed in Canada by Onter, Limited.

Roots-Connersville Reduces Gas Metering Costs 6 Ways...



Differential gauge is supplied as standard equipment on all meters.

Each meter is equipped with an integrator which records volume of gas directly in cu. ft. at line temperature and pressure.

Casing is fabricated from fine-grain cast iron, well-ribbed to prevent distortion due to operating pressure up to 125 lbs. or more.

Timing gears at each end of the meter prevent vibration and backlash.

Bearings are oversize, self-aligning and are readily accessible.

Gears operate within and are lubricated by an oil bath.

Impellers are made of fine-grain cast iron and are precision machined to fine clearances, holding "slippage" to an irreducible minimum.

1 *With Low Initial Investment.* One Roots-Connersville meter does the work of two or more meters of other types. Additional savings are made in piping, foundation and installation costs.

Comparative Analysis	SPACE OCCUPIED	TOTAL CAPACITY	METER COST	INSTALLING COST	TOTAL COST
FOUR DIAPHRAGM METERS					
ONE R-C METER					

Why buy two when one will do?

2 *With Permanent Accuracy.* Measuring chambers and impellers are precision machined to assure built-in accuracy. Free-rolling impellers have sharp edges making the meter self-cleaning.

3 *With Lower Maintenance Costs.* Roots-Connersville meters have no valves, valve gear or other small parts to wear out and cause metering inaccuracies. Maintenance is confined to lubrication of gears and bearings and an occasional field check of the operating differential.

4 *With Minimum Pressure Drop.* Straight-through design eliminates winding passages and restricting ports. Even at extremely low flows, Roots-Connersville gas meters retain "cash register" accuracy.

5 *By Maintaining Proof.* Accuracy is not affected by variations in specific gravity or rate of flow, pulsations, type of gas handled, pressure drop, entrained impurities, water level or other factors.

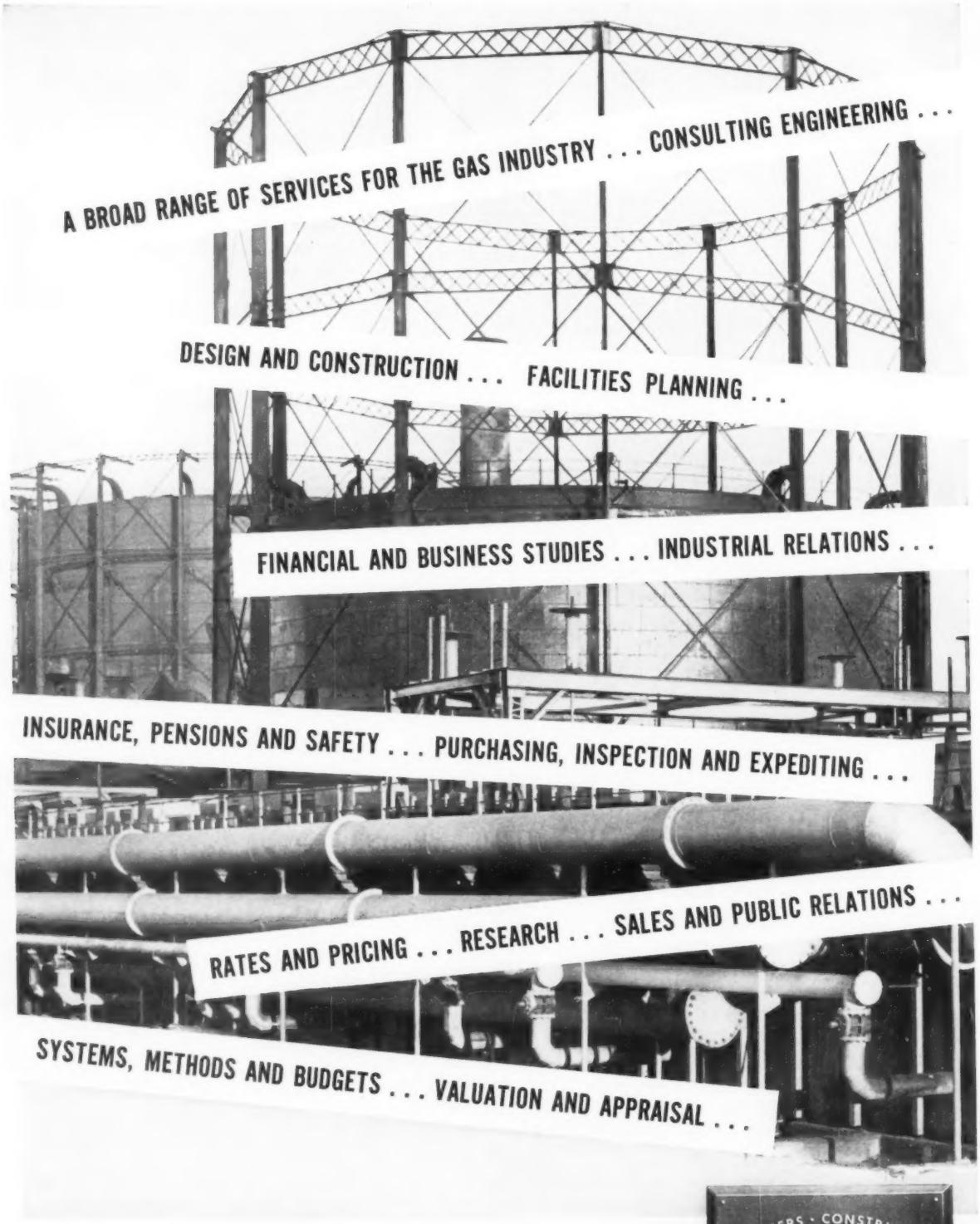
6 *By Providing Large Rated Capacities.* Capacities range from 2000 to 1,000,000 cfh with an operating range of 15:1, eliminating the need for multiple meters and assuring low cost/cubic foot/hour metering.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

1258 Oregon Avenue, Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.

For additional data, please refer to our section in **Mechanical Catalog** or **Chemical Engineering Catalog** or write for your copy of descriptive Bulletin M-152.


A BROAD RANGE OF SERVICES FOR THE GAS INDUSTRY . . . CONSULTING ENGINEERING . . .
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For a complete outline of the services Ebasco offers, send for "The Inside Story of Outside Help." Address Ebasco Services Incorporated, Dept. F., Two Rector Street, New York 6, N. Y.

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GAS

DECEMBER 1958

Eastern utility inserts new mains into old ones

NEW techniques for elevating pressures in city mains which could have widespread adaptability are being developed by engineers at Consolidated Edison Co. of New York, Inc.

Con Edison is replacing large, low-pressure mains with smaller higher pressure mains of several times the capacity. It is doing the work in the most congested city in the nation, where minimum traffic interruption is a must, and labor costs, because of scheduling problems, are fantastically high. It is finding its answer in the insertion of the new mains into the old.

This technique was used some weeks ago in the hub of the great city's population, Times Square. Here an old 24-in. main was replaced by a 16-in. tube over a distance of 1700 ft along Broadway, from 35th Street to 42nd. Only 310 ft of the street was disturbed. Because of dips and bends in the old pipe, the length of each section that could be pulled through as a unit was limited, but in one area a single length of 545 ft was used.

The technique is still being improved, and is currently being used on a large main which will supply natural gas from the New York facilities line, across the East river from Manhattan. This line passes through an existing tunnel under the river, emerging at the "head house" at 71st Street and Franklin D. Roosevelt Boulevard, on the east side. From the head house, gas is brought south to First Avenue and 39th Street, near the United Nations building. Later the line will be extended west across midtown Manhattan.

The existing southerly line is composed of 30- and 36-in. pipe. Inside it, Con Edison crews are installing 9000 ft of 24-in. and 700 ft of 30-in. main.

The job began with a survey to establish the maximum lengths of pipe that could be inserted as complete units. Exploratory cuts were first made in the old

Setup for pulling operation. A 50-ft cut is made to accommodate 40-ft lengths of pipe. Split section of pipe serves as cradle to position lengths to be inserted in old line. Hoist in foreground is used in aligning sections and guiding them through conduit line.

GAS staff report

Section of pipe ready to be lowered in. Pipeline crossing insulators are already in place.

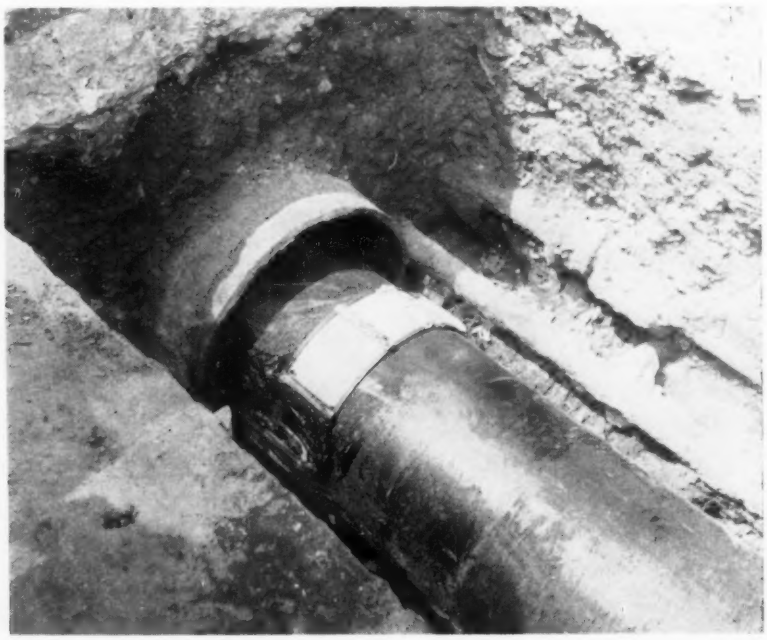
pipe at intervals of approximately 500 ft. Wherever practicable, street level indications as well as existing records were used to determine where cuts should be made.

Next, a target was inserted in the pipe. This consisted of a set of crosshairs, mounted on a pipe tripod and illuminated from behind by a flashlight. The target was pulled through the pipe with a cable, which was marked off in 10-ft lengths so that readings could be taken at these intervals. Engineers using transits set up at the extreme end of the cut pipe sighted on the crosshairs at each interval.

After the complete section had been surveyed, a plan and elevation were made to scale. Over these, a strip representing a scale of the pipe to be inserted was laid to determine the maximum allowable run.

After the section was plotted, a site was selected for the feed hole and excavated to a length of 50 ft, allowing room for laying in the 40-ft lengths of pipe. Approximately 50 ft of the old pipe was removed. The remaining pipe was thoroughly cleaned out to eliminate possible obstructions, and insertion was ready to begin.

New pipe used was epoxy-resin coated and fitted with Maloney Model 55 pipeline crossing insulators. These are insulating bands, made in two halves and bolted together on the pipe. The inner liner of neoprene is covered with a steel shell. A row of steel



Before insertion, insulators are heavily greased to facilitate entry.

skids is mounted circumferentially around the shell, and before insertion these were heavily coated with grease.

Since Con Edison feels the technique is still in the developmental stage, two inserting methods—pulling and pushing—are being used. In the former, a cable is run through the pipe and hooked to a conical cap welded onto the forward end of the pipe. This section is pulled until room is made for another 40 ft section in the feed hole. The new section is lowered in place, welded to the butt of the pipe already pulled, and the process repeated. At one point where a straight line pull would have blocked a main avenue, the winch was placed at a right angle to the main and the pulling cable was threaded into a sheave, which was secured in place by a second cable, running through a separate section of pipe running at right angles to the main being worked on, and anchored to an I-beam.

On this type of job, each length of pipe being butt welded before insertion is positioned and held in place by means of a cradle consisting of a half-section of larger diameter pipe, split longitudinally. Exact lineup is done with standard clamps.

With the pushing method, a two-way hydraulic jack riding on a two-rail track is used. The track is set on the floor of the trench and the jack is propelled forward in a series of short takes. Dogs on the jack assembly engage with notches in the rails to hold it in place as the cylinder extends to its full length. Then the entire assembly is moved forward to a new position and the cylinder once more is extended.

The jack, which was developed by the methods division of Consolidated Edison's outside plant construction department, uses a Rogers high pressure pump system, with a 2-gpm rating at 7500 psig. The assembly develops approximately 15 hp and has a capacity of 100 tons. Maximum travel of the jack along the rails is 50 ft.

The jack is much slower than the pulling method, making only 1.5 ft per minute as against approximately 20 ft per minute. It also requires more setup time. On the other hand, it requires less labor and is less disruptive to traffic. Choice of one method as against the other, then, is dependent upon these and other factors, including cost and contour of the enclosing main.

Two major factors, economics and public relations, have led Con Edison to adopt the new techniques, and they are interrelated. Stripped of ramifications, the simple fact that the amount of city streets that must be torn up is reduced by 75 to 85 per cent, is in itself a worth-while saving. The actual installation costs are also greatly reduced, as is shown in *Table 1*, which

Sequence at right shows how new pipe was inserted at heavily traveled intersection with minimum of interference. Top picture shows location of short, auxiliary cut. Pipe passes under street from right to left and extends into intersection in background. Pulling mechanism is located at this point. To prevent total obstruction, truck mounted winch (center picture) was set up at right angles to line of pull, and cable threaded over sheave secured to another cable running in opposite direction through another section of pipe. This cable was anchored in pipe a few feet from intersection, access hole used for anchorage was plated over (lower picture) and traffic diverted on both sides.

TABLE 1. Comparison of estimates for installing 9305 ft of 24-in. gas main and 730 ft of 30-in. gas main from 71st Street and East River to 39th Street and First Avenue, New York City.

	Open Cut Method	*Pulling and Jacking Methods*	
Install 8190 ft of 24-in. main inside existing 30-in. main (including preparation and receiving pits)		$ 425,560	Note 1
Install 8190 ft. of 24-in. main utilizing lane of existing 30-in. main where possible to avoid rock removal	$ 900,900		
Install 1115 ft. of 24-in. main in new tranch	164,415	210,618	
Elimination of interferences, X-rays, and misc. work	30,250	33,042	
Special fittings, etc.	5,080	16,779	
Service installation	14,000	14,000	
Regular installations	300,000	300,000	
Sub total 24-in. main installation	$1,414,645	$1,000,000	
Install 600 ft. of 30-in. main inside existing 36-in. main (including preparation and receiving pits, special fittings, etc.)		52,250	Note 2
Install 130 ft. of 30-in. main, open cut and associated costs		39,250	
Install 730 ft. of 30-in. main in new trench including associated costs	116,070		
Grand Total 24-in. and 30-in. main installations	$1,530,715	$1,091,500	

Note 1. Based on actual installation of 200 feet by pulling methods. Field observation indicates a possible saving of 20% of this estimate.
2. Based on actual installation of 120 feet by jacking method. Field observation indicates actual cost will approximate estimate.

tabulates estimated expenditures for the open cut method vs. pulling and jacking.

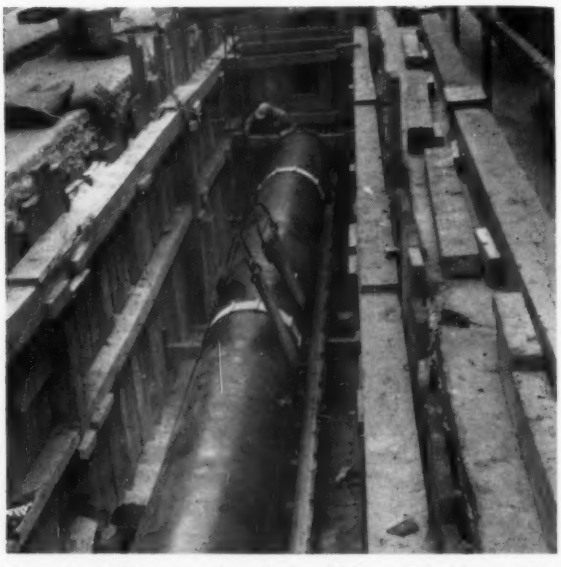
But this is only part of the economics story. Because of the severe traffic conditions, the city requires that interruptions be held to the minimum. This means that in certain areas open hole work has to be done in the evening hours, after the day's traffic has passed its peak. But because there are so many apartment houses scattered throughout the city, this activity must be cut off well before midnight. Sometimes the working day is cut to a matter of four or five hours. Productive hours are even less, since spoil must be carted away and most cuts plated-over for the next day's traffic.

In those areas where daytime work is permitted, traffic must still continue to move. Tighter and tighter working areas are needed, and the insertion technique helps make this possible. Cranes used to lower the pipe, when not in active use, are parked at the end of the trench, cutting impediments to a single lane. When it is necessary for them to come alongside, they do it quickly, drop in the pipe, and back off to the parking place again.

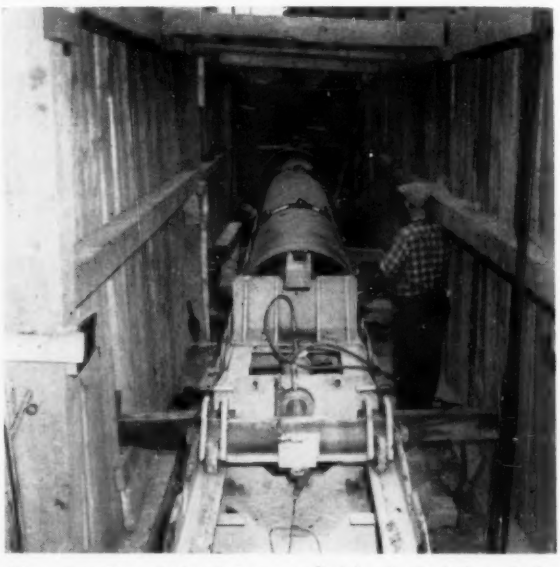
Plating is a much simpler matter with the short trenches.

A good example of how interruptions to traffic were minimized is the instance where the right-angle main was used as an anchoring conduit. This was located at a busy intersection, which could have been blocked had a straight-through pull been used. But by having the truck-mounted pulling engines headed at right angles, they were removed from the intersection entirely. The area where the cut was made for the anchorage was plated over. Only a single lane was impeded on each street.

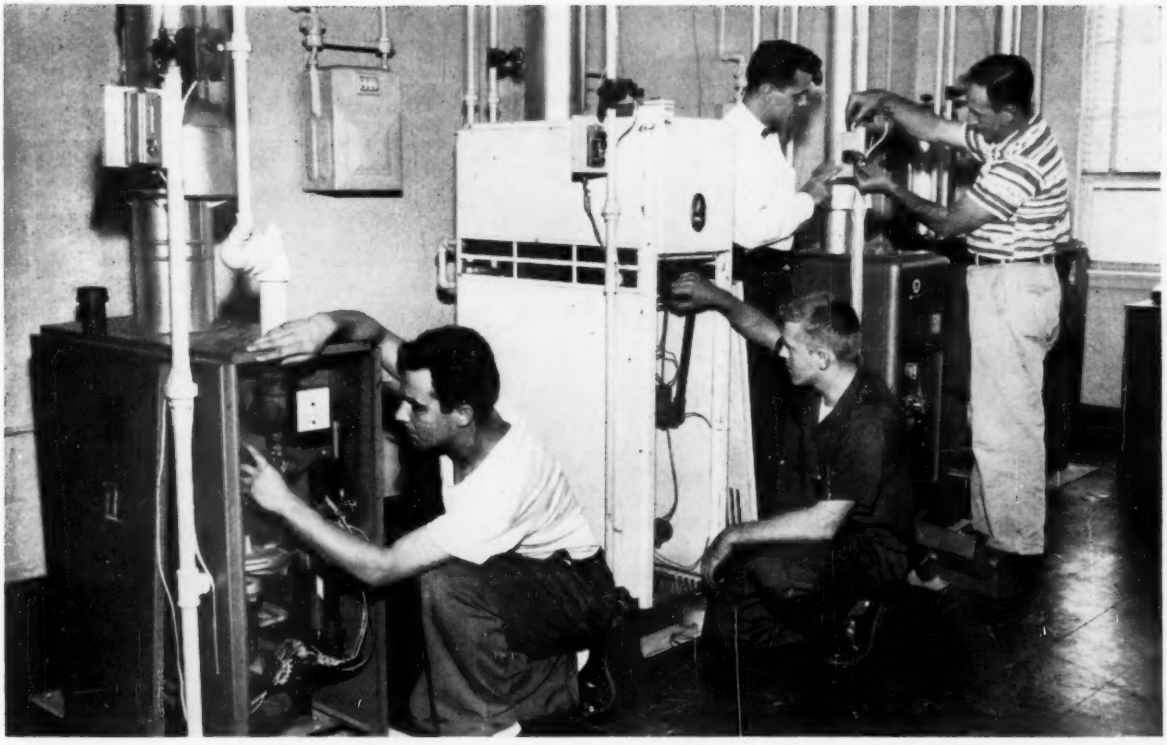
The public relations aspects of the techniques are obvious. Con Edison is showing again that it is trying to be a good neighbor. ■



Setup for jacking pipe through the old line. Jack rides on twin rails in bottom of trench.



View of section of pipe being propelled by the jack through the old line.



Students rebuild and check out controls systems on warm air furnaces under guidance of Washington Gas Light Co. staff assistant C. S. Embrey (rear).

Washington Gas believes in thorough service training

By WILLIAM W. CLARK, Eastern Editor

WHAT may be the most thorough training program for gas company servicemen in the United States is being carried on at the Shirley Highway Service Center of Washington (D.C.) Gas Light Co., just across the Potomac in Virginia.

"By the time a serviceman has been employed six years, he will have probably completed about 50 days of service training," says G. R. Thompson, Washington Gas' supervisor of training.

This service training begins the moment a man is hired for service work, and in one form or another it goes on intermittently as long as he serves in this capacity. First, there is indoctrination; then there are the various qualifying courses; finally, there are frequent refreshers and special courses.

Supporting the instruction are a broad variety of training aids, ranging from water heaters that suffocate themselves to a "voice mirror." In between are film strips, recorded tapes, operating appliances, and a long battery of mock-up control boards. With them, the men do everything from tearing down and reconstructing complete automatic appliances to practicing the exercise of diplomacy with imaginary housewives.

Through it all, the training staff maintains a close watch on each man's progress, giving him frequent tests and keeping detailed records of his performance.

On his first encounter with the training division, the prospective serviceman is given the same sort of close, personalized attention that he will encounter throughout his gas company career. Indoctrination takes three days, and "classes" are limited generally to three men. Before the three days are over, the man will have learned a great deal about his company, about his job, and about the fuel and will be well grounded in company procedures.

The training staff explains the functions of the various departments in the company and tells how each fits into the general pattern of fuel distribution

"Student" at qualification school for assistant servicemen practices lighting of domestic water heater under supervision of staff assistant Guy Tuel at right.

in Washington Gas service area. They brief him on the operations of the service department, and introduce him to his immediate supervisor and the employee he is to be working with. A 12-minute tape tells the story of natural gas—where it comes from, how it is stored, how it is utilized, and its combustion characteristics.

Several demonstrations are made to illustrate points in the lecture. The characteristics of combustion are shown with a Bunsen burner. A luminous type burner is simulated. Incomplete combustion is demonstrated, the students being shown how aldehydes, which accompany it, attack the nostrils and make the eyes smart.

One of the most dramatic performances is a small, perfectly controlled explosion, which is set off in a specially constructed box to impress upon the men the danger of introducing air into gas in an enclosed space.

The final session covers such matters as customer billing, payroll procedures, and policies relating to employment, a loose-leaf booklet of operating instructions, and introduction to their next training course in the form of a questionnaire.

The instruction booklet is a publication compiled by Washington Gas, and data on the several distribution pressures used in the service area, and the different types of installations and tests as required by the variances among jurisdictions in which the company works; meters and regulator—sizing and capacities for single sets and battery hookups; range information, such as nomenclature needed for ordering parts; electrical circuits; water heaters and heating with almost 100 wiring diagrams included; controls settings; refrigerators, with orifice charts and maximum and minimum pressure settings; and commercial appliances, including fat fryers, bake ovens, etc.

The questionnaire contains a master list of 187 questions covering natural gas and gas utilization, venting and ventilation, orifice capacities, ranges, water heaters, refrigerators, regulators, gas meters, meter reading, and househeating. During the ensuing six months, he will be expected to study the questions and make himself aware of the problems covered, so that he will be ready to take the first real step up the gasco ladder—the qualifying school for assistant servicemen.

• Qualifying school for assistant servicemen

This course, given at the end of an employee's first six months of work, extends over an 8-day period, and is laid out to check his ability to grasp instructions on meters and regulators, and to make minor adjustments on domestic appliances.

To achieve maximum of comprehension and permit close observation of each student, classes are limited to five men.

The course is thoroughly planned from start to finish. Subjects are arranged in the same order as they are on the master list of questions, and as each is covered the corresponding questions are discussed and answered.

The first seven days are given over to classroom lectures, demonstrations, practical and written work. As work progresses three written quizzes, or "training questionnaires," containing selected questions taken from the master list, are given.

On the eighth day, following the final examination, each man is given a practical test on the execution of a meter order, on which time required is a measurement of ability. Seven standard problems have been set up for test. Scoring is based on standardized criteria, which cover time as well as performance. A detailed check list has been set up, and as the instructor observes the progress of each student's test, he records each wrong move and makes a corresponding standardized deduction.

The last item in the course is a mechanical aptitude test, in which each man must disassemble and reassemble a unit-type water heater control.

The man's final grade is based on four components; the average of his combined scores on the three training questionnaires, the final written test, the practical test and the mechanical aptitude exercise.

After the grades have been compiled, they are reported to the man's foreman through his general foreman.

Because of its intensity, this course gives the training department a keen insight into a student's abilities, temperament, and personality. It is here that those who do not measure up may fall by the wayside. On the other hand, men who do well will have made a good start toward eventual attainment of some of the higher and better paying servicemen's classifications.

Having completed the course, and a total of 12 months satisfactory probationary service, the employee may become a normal assistant serviceman until upgraded. Promotion is based upon two factors: a vacancy in the serviceman's classification

and qualification. This latter is determined by his standing in an eligibility course and his seniority.

• Servicemen's eligibility school

After two years in the company's employ, the assistant serviceman is given this course to determine his qualifications for upgrading. Thirteen days of instruction are given on a single subject, househeating.

The first 11 days are devoted to instruction, demonstrations, and practical work on controls and control systems. On the 12th day a practical test, covering a full eight hours, is given; during that time, each man completes as many heating "complaints" as he can from a list of 15 orders. On the 13th day, he is given a written test consisting of 25 questions taken from a master list of 231 questions which were distributed the first day and discussed throughout the course.

This course begins with a review on orifice capacities, combustion, venting, and pressure. A study of house and appliance regulators follows, after which the construction and operation of eight different diaphragm valves are explained. Other primary control valves, including motorized valves and mechanically operated valves, are next explored, followed by secondary control valves, including limit controls and solenoid control valves.

Part 7 in this course covers gas control systems, Part 8 electricity, Part 9 room thermostats, Part 10 miscellaneous controls, and Part 11 heating systems.

Each student is graded on the basis of both the practical and the written test. His score determines his place on an eligibility roster. Servicemen are drawn from this as opportunities open up for them. Selection is then made in numerical order from the top of all rosters.

The top men on the eligibility roster are also given 10 days' further training on domestic appliances, plus five days of field training with a serviceman. This qualifies them to fill in as servicemen on a temporary basis when the need should arise, such as during peaks in the work load.

• Refresher course for new servicemen

After an assistant serviceman has won a place on the eligibility roster, he must wait for an opening before being promoted. Some months may elapse in the meantime. Therefore, when he moves into the higher classification, he is given a refresher course consisting of 10 days on househeating and five on domestic appliances. Generally, these courses are given to dovetail with the season. For example, if the company is about to go into a househeating season, the 10-day course will be given immediately and the domestic appliance course will be delayed until the season has ended.

• Special servicemen's eligibility school

The next step in training is for the special serviceman classification, which qualifies him for position on an eligibility roster. To win a place on this eligibility roster, he must attend a five-day school which covers absorption air conditioners, premix equipment, proportional mix equipment, and power burners.

The first three and a half days are given over to instruction and demonstration, followed by a half-day written examination. The fifth day is devoted to practical tests. A mock-up board is used for continuity tests to determine the trainee's ability to wire circuits properly. A powerstat is used to give variable voltage settings, fans and motors are overloaded, air inputs are dampened, etc., to test the student's ability to spot the faults and correct them. His grade and seniority determine his standing on an eligibility roster.

• Air conditioning school for special servicemen

When he is ultimately selected for the special serviceman classification, he is again brought in for training, this time on air conditioning.

Classroom study, demonstrations, and exercises consume five days. A great deal is packed into the five days. After he has satisfactorily finished this training, the qualified man is then sent out into the field to work for 10 days with one of the more experienced special servicemen.

• Commercial and industrial school

As he moves into this classification, the new special serviceman gets a 10-day course on industrial and commercial gas burning equipment. This course covers combustion; types of burners, with a detailed study of the proportional mixer, immersion-type water heater, and premix equipment such as is used in lead melting pots in printing plants; relays, safety pilots and shut-off valves; power burner controls systems; ventilation, draft, and energy; steam generators; and electronic control systems.

The first seven days are given over to classroom work, the final three to field trips, which include practical work with instructors.

Finally, before going on his own, he works for two weeks in the field with an experienced serviceman.

At this point, a man may have completed as much as 64 days of training, and is exceptionally well qualified to solve any sort of service problem that might be encountered in the field. But Washington Gas service supervisors are well aware that a man's training never really ends. It's only human nature to slip into bad habits, and from time to time his work must be checked to find them and correct them before they become serious. Appliances, equipment, and controls are constantly being improved, modified, or made more complex, and all servicemen must be kept abreast of these developments.

Refresher courses are one means of accomplishing these ends. Servicemen are reschooled on domestic appliances once every five years or so. After about a year as a qualified special serviceman, an employee is given a five-day refresher on air conditioning and another five days on commercial and industrial equipment.

Each year, assistant servicemen are given special training on light-ups for the coming winter househeating season.

Outline for assistant servicemen's qualification school

I Introduction
- A. Purpose
- B. Distribution of master list of questions
- C. Subjects to be covered
- D. Explanation of grading system
- E. Importance of customer relations
- F. Numerical check on Operating Instructions in Service Hand Book

II Natural gas and gas utilization
- A. Definition of combustion
- B. Composition of natural gas
- C. Composition of air
- D. Demonstration of explosion box

III Venting and ventilation
- A. Definition of a draft and how originated
- B. Method of computing proper size of ventilation openings
- C. Regulations regarding venting
- D. Use of flue divertor
- E. Method of computing manifold size of appliance flues

IV Orifice capacities
- A. Definition of an orifice
- B. Method of drilling orifices and arriving at proper size

V Ranges
- A. Method of adjusting top burners
- B. Method of adjusting top burner pilots
- C. Difference between standard and C.P. range
- D. Determining input
- E. Importance of properly adjusting by-pass and standby pilot on ovens
- F. Practical work on ranges

VI Water heaters
- A. Types
- B. Principle
- C. Safety Controls
- D. Method of computing BTU's necessary to raise a given amount of water to a given temperature
- E. Thermostats
- F. Practical work in lighting

After completion of coverage on water heaters, training questionnaire part 1 number 1 or part 1 number 2 shall be given.

VII Refrigerators
- A. Principle of operation
- B. Principal parts
- C. Installation hints
- D. Service hints
- E. Practical work in lighting

VIII Regulators
- A. Types
- B. Principle of operation
- C. Explanation of P.S.I.
- D. Inspection procedure and testing
- E. Practical work in executing regulator and meter orders.

After completion of coverage on regulators, training questionnaire part 2 number 1 or part 2 number 2 shall be given.

IX Gas meters
- A. Purpose and construction
- B. Sizing meters
- C. Diversity Factor
- D. Regulations pertaining to the location of meters
- E. Clocking flow
- F. Practical work in reading meters

After completion of coverage on gas meters, training questionnaire part 3 number 1 or part 3 number 2 shall be given.

X House heating
- A. Types
- B. Methods of transmitting heat
- C. Primary and secondary controls
- D. Standard warm air
- E. Counter flow
- F. Open and closed hot water systems
- G. Steam and vapor systems
- H. Conversion burners

Final training questionnaire number 1, number 2 or number 3 shall be given and a practical test will be conducted on the last day of class.

Another method is quality control, which was instituted in 1957 to enable the company to check the men's work in the field and take steps to correct bad practices. Complaints and servicing reports turned in by the men are routed to company inspectors, who use a random sampling technique in checking service work. Identities are cloaked to prevent favoritism and each man's work is graded by the inspector. Through this means, the service department can spot weakness patterns.

A concomitant is a service hint program. These hints are prepared by the training department, using pictures, cutaways, and components as appropriate, and are posted on a bulletin board at each station. A copy is also routed to each supervisor. If the hint is considered important enough, a copy is also given to each serviceman. A permanent file is kept of the best ones. This program lays particular stress on safety, which is of paramount importance in all phases of the training program.

Further supplementing the training routines are service talks, which the training staff presents occasionally at each station.

Still another device used to train servicemen is the customer relations sessions. With increasing emphasis being placed upon the value of winning friends among customers, the department has devised a one-day school annually during which all servicemen are brought in and briefed on how to conduct themselves when on calls. Classes are limited to 10 men in order to allow plenty of opportunity for discussion and participation.

One of the most effective presentations in this school is the "voice mirror." Men are paired off and one acts out the part of the customer, the other the serviceman. The "customer" is given a complaint card, which lists a common difficulty, such as "poor heat." The "serviceman," in turn is given a card indicating some inherent fault in the system, such as "distribution system undersized."

The "customer" proceeds to complain as bitterly as only a disgruntled customer can, and the "serviceman" must handle the situation as diplomatically as possible. The "customer" tries to bait him into laying the blame on the system, and he tries to soothe the customer's ruffled feelings without damaging the

equipment manufacturer's or installer's reputation.

As the men are talking, their conversation is being recorded. It is then played back so they may see how they have fared, what their weaknesses are and how they might have handled this situation with better results.

The customer relations session is also used to inform the men on other matters which they should be kept aware of. They are given a tour through the company's utilization laboratories to learn about the latest appliance testing techniques and developments. They are also instructed by the assistant superintendent of service, training, who talks on policy matters, such as company merchandising practices, warranties, etc.

By making training a continuing activity, the company is able to keep classes small yet give men a maximum of schooling. Three full-time instructors, recruited from the ranks of top-notch servicemen, are attached to the training activity. The supervisor fills in as an instructor as needed, and frequently as many as three classes will be going on simultaneously (although generally the number is held to two). The number of men eligible for training by them is less than 400.

Scheduling of classes is carefully worked out with the dispatch supervisor so as not to cause any slowdowns in service work. When a class is to be called into session, the training section broadcasts the schedule and the list of men to all interested persons for routing. By keeping classes small, he can pull servicemen out of the field with a minimum of inconvenience.

A complete record of every man's training progress is maintained on a file card.

The school staff has a wide range of physical and visual aids for use in its work. Three projectors, as well as tape recorders, are used extensively. A large library of strip films and slides is maintained. Many of these were made up by the company itself, others were provided by manufacturers. They are effectively used to point out small details in design and functioning of systems, such as pilot light settings, controls settings, etc.

One classroom is well stocked with meters and regulators of every type to be encountered. A board containing nearly 100 meter indexes is used for practice in reading.

A furnace is set up in a closet with duct openings to demonstrate the effects of the fan on chimney draft. An enclosure is now being constructed so that the furnace can be deprived of air, which will demonstrate how it can suffocate itself.

Another room is banked with water heaters, elevated from the floor for instruction purposes. Here recovery demonstrations can be made and efficiencies tested by means of temperature readings. Baffles and diverters can be removed to illustrate their importance and the heaters can be suffocated. Cutaways are also used to show interior construction. Thirty water heater thermostat manipulation boards are also on hand for student use.

In the range and dryer room, models of both appliances are available for complete dismantling, study of accessories such as probes and thermostats, and rebuilding.

In the refrigerator corner, several working models are used, including an ice maker, which is disassembled and reconstructed by the students. Easels and slides are also used.

One large room is entirely devoted to training in all types of heating appliances. Working models and mockups of control systems, diaphragm valves, mechanically operated valves, and other types of systems are used by the students in assembling exercises. Along one wall is a battery of warm air units, illustrating major types of units encountered in the field. Along another wall are boilers and a 5-ton Arkla Servel air conditioner. All are operative, with warm air being collected in a common header and bled out the window to the atmosphere. The air conditioner can be operated with either city water or by a cooling tower.

Along a fourth wall are premix, proportional mix, and power burner equipment, complete with all controls and accessories. All are set under a draft hood which carries off heat and products of combustion.

The training group has also written and compiled a number of service manuals, which are issued to the men as they take their classroom work.

In spite of the thoroughness of the training and the detailed instructions that are given, they are strong believers in keeping the work simple and as non-technical as possible. As soon as an instructor begins to talk over the heads of his students, his supervisor offers a word of caution.

"We're trying to teach them, not impress them," he declares. ■

Washington Gas Light supervisor G. R. Thompson discusses the quality control program and plans for future customer relations sessions with service department personnel.

Changing soil conditions caused Lynn Gas & Electric Co. to begin a system-wide policy of corrosion prevention. Now, they've standardized on one type of coated pipe.

New England utility adopts plastic-coated steel pipe

ONE of the first companies in the United States to standardize on the new plastic-coated steel pipe is a gas utility that in the past has had only scattered sections of its system protected, yet has had few corrosion problems. So why should it adopt one of the newest corrosion-resistant materials for all new main and service extensions?

"The effects of changing conditions and an awareness of the need for proper protection of investment in underground facilities," is the answer given by S. J. Topping, superintendent of the gas distribution division of Lynn (Mass.) Gas & Electric Co. "You might say it's an application of the 'ounce of prevention' idea."

These conditions are varied—partly environmental, and partly economic. For one thing, the soil potential in the area has undergone a change since electric railways were abandoned a few years ago. And system expansion is pushing out into new areas where soil properties differ. What types of environment might be faced in the future is conjectural at this point.

Cost-wise, the move had two principal aspects. First, there's the balance of material price vs. labor expense. The former steadily diminishes in importance as the latter continues to increase. The small extra cost of factory-protected pipe is considered incidental when weighed against the possibility of having to excavate, search for leaks, etc. The less attention it requires, once in the ground, the better. Secondly, savings may be realized simply by eliminating the element of decision. The question of where to protect and where not to protect can only be answered on the basis of tests,

Lynn Gas & Electric Co. has standardized on plastic coated pipe for both mains and services. Here Stanton M. Ferguson, Lynn gas engineer, checks a run of main being installed to serve a new subdivision in Lynnfield, Mass. Note that joints as well as nicked areas are taped with polyethlylene pressure sensitive material.

GAS staff report

S. J. Topping, superintendent of gas distribution, points to a valve housing on a lateral, where cold applied mastic is used to give continuity of protection against corrosion.

computations, consultations and experience and these can be costly in themselves. So Lynn's answer was, use the pipe on *every* job.

In spite of its locale, Lynn Gas & Electric has had little experience with the effects of corrosion. Situated on the seashore just north of Boston, it serves a half-dozen communities in a nine-mile radius through 350 miles of main. Lynn, Swampscott, and Marblehead front on the ocean. Nahant is a small peninsula extending into the Atlantic, connected to the Lynn mainland by a causeway. Lynnfield and Saugus are a short distance inland. With the exception of the waterfront and a few spotty areas, the soils encountered have a high resistivity—in the order of 30,000 to 200,000 ohms centimeter.

Older mains are wrought iron and cast iron but in the past 30 years a great deal of bare steel pipe has been laid. Only a few lines have been coated. One is the Swampscott-Marblehead feed line, which was hot-wax-treated and wrapped with fiberglass and kraft paper. It was laid about three years ago, and since that time cathodic protection has been applied. In some other areas where the soil is swampy or high in peat or clay content, cold applied mastic was used.

Through the years until recently, much of the rest of the system was cathodically protected by stray currents leaking from the rails of the electric railways. Most of the areas where corrosion was at all severe were centered near the railway company's substations, where the currents left the gas pipes. In the past decade, all of the railway systems have been removed with the exception of the Metropolitan Transit Authority's elevated and subway system, which terminates at Revere. Stray currents, then, are a factor (for good or for evil) in only a portion of the system.

With the changing conditions, as well as the growth into new areas, Lynn felt it would be wise to standardize on a single method of pipe protection. It was reasoned that if a factory-coated pipe of good corrosion-resistant properties could be obtained, laying procedures could be standardized, pipe inventories could be held to a minimum, labor costs could be reduced, and testing for corrosion could be regularized as well as minimized.

The plastic-coated steel pipe manufactured by Republic Steel and trade-named "X-Tru-Coat" (see *GAS*, March 1958, pages 75-6) was chosen. This pipe, available in sizes up to 4.50-in. OD, is factory-coated with an extrusion of polyethylene of thicknesses ranging upward from 0.025-in. applied over a live elastic, adhesive undercoating of 0.005-in. thickness. The material was a high insulation resistance (500,000 megohms) and dielectric strength (25,000 v). Moisture absorption is only 0.01 per cent.

Aside from the protection features, the pipe had some advantages in handling that were attractive. Because of the toughness of the polyethylene and the resilient adhesive, it could stand up better under rough treatment than other, less resilient coatings. Rocks can be bounced off the tough hide without piercing it, so there's less danger of creating holidays during backfilling. This same resiliency makes it less susceptible to the damages of soil stresses, which could invite corrosion. The pipe can be bent in the field without damage to the coating, which "gives" with the bend-stress.

In handling, any nicks that do appear are taped. Those which might escape notice—for example, if they are damaged in backfilling—are self-sealed by the cold flow of the adhesive, which fills the gap.

The first shipments of pipe were covered with black plastic. Subsequently, Republic has improved the

Field welding is proved to be quick and easy on this job. The coating was slit and stripped back from the end with a knife. Because of its relatively slow heat flow, only about 5 in. of coating had to be removed instead of the customary 1 ft.

Nicks are easily located and taped. Because of the bright yellow covering over a black adhesive material, nicks show up quickly on visual inspection. On this stretch of pipe, several areas required taping because of extremely rough handling. Ordinary — even moderately rough — handling will not damage the coating.

coating by using a new linear-type polyethylene. This prevents oozing of the material at the joints. This material is also even tougher than the original.

The new coatings are a bright yellow, which Lynn engineers consider a big improvement over the black due to its ease of visual inspection. Abrasions which have cut the coating and expose the adhesive stand out conspicuously. Shipments can also be inspected quickly and thoroughly. When pipe is stacked beside a roadway, it practically shouts its presence; this helps prevent motorists from inadvertently driving over it. The color also makes the pipe very noticeable when the ground is redug at a later date by other utilities.

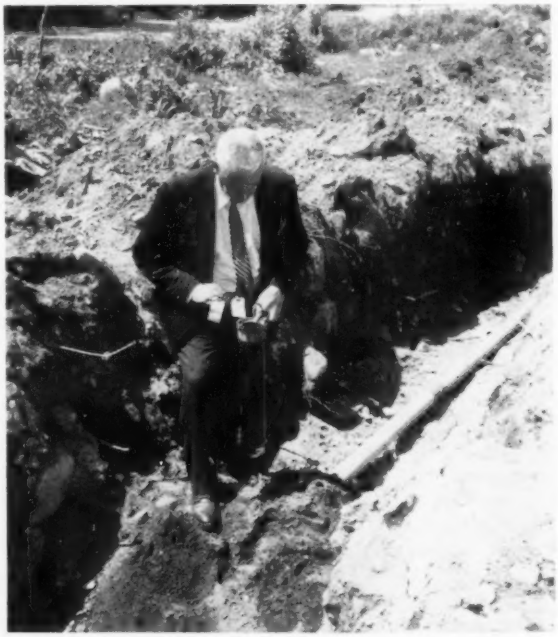
The pipe is installed in 40-ft lengths. Joints and abrasions are taped with a polyethylene pressure-sensitive material, which is claimed to have a higher dielectric strength than polyvinyl. Since the X-Tru-Coat plastic doesn't heat flow as readily as some other coatings when heat is applied, it needs to be cut and stripped back only about 5 in. (instead of the customary foot) at welds.

Cold-applied mastic is used to protect valve housings.

On longer mains (1000 ft and up) additional precautions are being taken to protect the pipe against corrosion. Magnesium anodes are used if soil resistivity measurements indicate their need. A standard drop station is installed for taking future electrolysis measurements. This consists of two risers made of composition pipe, which are spaced 100 ft apart and brought up from the top surface of the main to ground level, and capped. Four No. 12 covered wires are cadwelded to the main and led up through the risers. Tests will be made annually at each station. If measurements indicate a need, cathodic protection will be installed.

In laying the pipe, Lynn's crews are careful to keep it elevated from the bottom of the trench to prevent bottom attack, which might occur if the hard-packed bottom was at a different potential than the backfill.

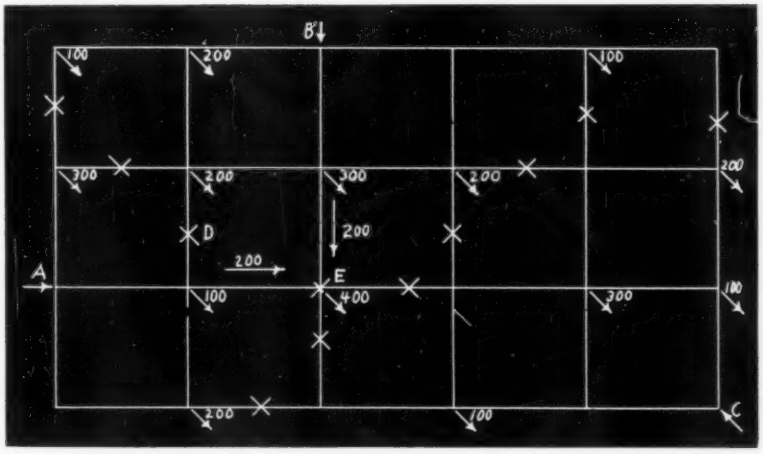
Even though the soil contains a good percentage of large rocks, the spoil bank is used for backfilling. With the plastic-coated pipe, it is felt that no special soils need be tucked in. The company believes that if reasonable care is used in blading the dirt back into the trench, with the blade working diagonally to the bank, injury to this tough pipe will be negligible. ■



Standard drop stations are located every 100 ft on longer mains (1000 ft or more). These will be used by corrosion engineer Roland H. Jacobs for making annual electrolysis measurements to determine whether cathodic protection is needed.

Distribution of flows in a network

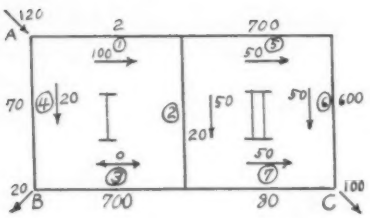
Here is a review of basic principles of gas network analysis with electronic computers. This series is specifically designed for readers to whom the art of electronics in gas system calculations is "new."



By K. J. STANTON, Chief Engineer
Northern Illinois Gas Co., Bellwood, Ill.

MR. HARDY CROSS, years ago when a professor of engineering at the University of Illinois, proposed a method of solving network problems. Knowing the loads in a network and the resistances of the pipe sections, certain calculations are performed successively for each loop in the network until a reasonable approximation of the correct answer has been obtained. The first step in the solution of a network by the Hardy Cross method is to choose the flow both as to quantity and direction in each pipe section. No experience or judgment is needed in this, but the closer the assumed quantities are to the correct quantities, the quicker the problem will be solved. Thus, the judgment of an engineer will tend to reduce the time involved in solving the problem.

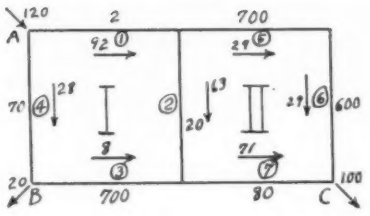
Fig. 12 shows the same network that was studied in the previous installment (*GAS, Nov. 1958, pp. 57-60*). For each pipe section, several calculations will be made in each step of the solution. First, we obtain the product of the flow and the resistance (QR), and this product is without sign. Next, we obtain the product of the flow to the X power and the resistance (Q^XR). These Q^XR products shall have a sign, and the sign is determined thus—if the flow is in a clockwise direction, the sign shall be negative; if it is counterclockwise, it shall be positive. This determination of the sign is a convention only, and other conventions might be used. The correction factor ($\triangle$) to be applied to the various flows in the pipe sections of the loop to bring the solution more closely to the correct one is obtained by the formula $\triangle = \frac{EQ^XR}{2EQR}$.



	LOOP I	LOOP II
ΣQR		
	200	35000
	1000	30000
	0	4000
	1400	1000
	2600	70000
ΣQ²R		
	−20000	−1750000
	−50000	−1500000
	0	+ 200000
	+28000	+ 50000
	−42000	−3000000

$$\Delta = \frac{-42000}{2(2600)} = -8 \qquad \frac{-3000000}{2(70000)} = -21$$

Fig. 12



	LOOP I	LOOP II
ΣQR		
	184	20300
	1260	17400
	5600	5680
	1960	1260
	9004	44640
ΣQ²R		
	−16928	−588700
	−79380	−504600
	+44800	+403280
	+54880	+ 79380
	+3372	−610640

$$\Delta \quad \frac{+3372}{2(9004)} = +0.2 \qquad \frac{-610640}{2(44640)} = -7.2$$

Fig. 13

The correction factor, with sign, is then subtracted from the various flows, the flows having the sign determined by the convention just mentioned. The direction of the revised flow is indicated by the sign. In the case of pipe sections common to two loops, the correction factor for both loops must be applied to the flow in such section. For example, in *Fig. 12*, in the case of pipe section 2, both the correction factor for Loop I and the correction factor for Loop II must be applied to the flow in pipe section 2. It will be noted that with reference to Loop I the flow in pipe section 2 is negative, while with reference to Loop II, it is positive.

Fig. 12 shows these calculations, and *Figs. 13, 14, 15 and 16* show how the correct solution is obtained.

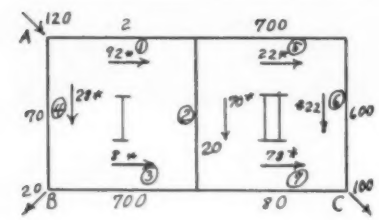
As has just been demonstrated, the solution of a network by the Hardy Cross method is a series of repetitive calculations involving addition, subtraction, multiplication and division. A digital computer is a machine which will very rapidly perform such computations together with a memory system in which instructions or information can be stored. Thus, it lends itself to mechanizing the solution of the network. All that is necessary is that we instruct the computer to make the calculations that we desire. How we do this will shortly be presented, but first we must describe some of the characteristics of the machine for which we shall write the program.

While there are many types of computers and probably any of them can be adapted to solving these network problems, the programs that will be presented here will be for a card-programmed calculator, that is one in which the information and instructions to the machine are supplied by means of punched cards.

On the card shown in *Fig. 17*, certain columns are labeled. The first eight columns are used to number the cards. The A-address is the address in the memory from which the number to be operated upon is taken. The numbers punched in the four columns headed "operation" determine the kind of arithmetical process to be used. The B-address is the address in the memory from which the other number in the operation is to be taken. The C-address is the address in the memory in which the result of the operation is to be stored. The A and B fields are means by which numbers punched in the cards may be introduced into the machine. The various arithmetical operations to be performed are shown in the following code:

Operation Code

01 ..... A+B

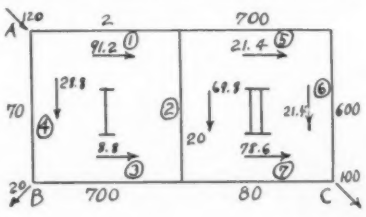


	LOOP I	LOOP II
ΣQR		
	184	15400
	1400	13200
	5600	6240
	1960	1400
	9144	36240
ΣQ²R		
	−16928	−338800
	−98000	−290400
	+44800	+486720
	+54880	+ 98000
	−15248	− 44480

$$\Delta \quad \frac{-15248}{2(9144)} = -0.8 \qquad \frac{-44480}{2(36240)} = -0.6$$

*Nearest whole number was in correcting these flows, i.e., zero for Loop I and 7 for Loop II.

Fig. 14



	LOOP I	LOOP II
ΣQR		
	182	14980
	1396	12840
	6160	6288
	2016	1396
	9754	35504
ΣQ²R		
	−16634	−320572
	−97440	−274776
	+54208	+494237
	+58030	+ 96603
	− 1836	− 4508

$$\Delta \quad \frac{-1836}{2(9754)} = -0.1 \qquad \frac{-4508}{2(35504)} = -0.1$$

Fig. 15

The Bright Yellow Pipe Stops Pipeline Corrosion

Republic X·TRU·COAT

PLASTIC-COATED STEEL PIPE AND TUBING COMBINES THE PROTECTION OF PLASTIC WITH THE STRENGTH OF STEEL

This pipe is really the answer to pipeline corrosion problems. Hundreds of miles of critical installations are proving it. In every application, X-TRU-COAT is doing everything the research boys said it would . . . and more.

Republic X-TRU-COAT combines the strength of steel with the excellent corrosion-resistance of plastic in a really effective pipeline corrosion fighter. Carefully selected Republic Butt Weld or Electric Resistance Weld Pipe is covered with a newly developed "high density" polyethylene plastic offering flexibility, high impact strength and good tear and puncture resistance.

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Republic X-TRU-COAT, the bright yellow pipe with the built-in corrosion-resistance, is available in a wide range of pipe and tubing diameters (through 5 9/16" O.D.) and various wall thicknesses.

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MORE REPUBLIC STEEL ANSWERS TO PIPELINERS' PROBLEMS

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Now being produced in 60-foot joints . . . 50% longer than ordinary joints. Thus, two "SUPER-SPAN" joints cover the same distance as three ordinary lengths. With "SUPER-SPAN" on the job, you eliminate every third field weld. You save time and manpower. And, you get all the other advantages identified with Republic Fusion Weld Line Pipe—interruption-free laying . . . fast, accurate line-up of joints . . . no thin spots to burn through . . . easy field bending . . . dependability in high pressure service.

REPUBLIC ELECTRIC WELD LINE PIPE

The "workhorse" of the industry. Pioneered by Republic. Proved by the thousands of miles put into the ground during the past 30 years. Always easy to line up, fast to weld. Uniform wall thickness, uniform roundness assured by Republic's Electric Weld Process. This process converts high quality flat-rolled steel to uniform tubular goods with the weld fully as strong as the rest of the wall. The process also assures a ductile pipe, for easier field bending without wrinkling.

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H-17500 SERVICE TEE

Installed under pressure.
May be stopped-off at any time.
Activated with "E-4", "EH-1", "D-4", "DH-2" or "T" Machines.
Welding or threaded inlets.
Welding, threaded, Dresser or insulating outlets.
Cast iron cap for pressures to 250 P.S.I.
Steel cap for pressures to 1200 P.S.I.
Outlet sizes from ¾" through 2½".

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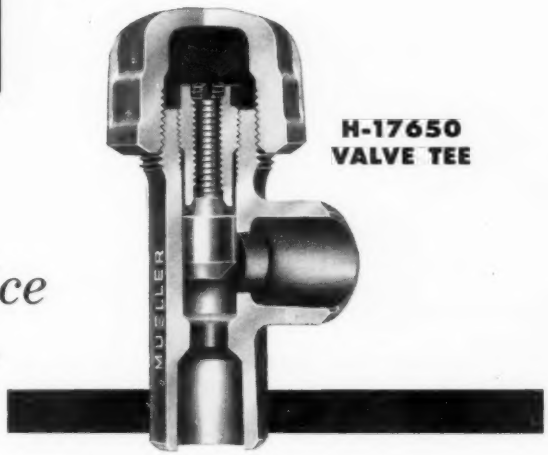
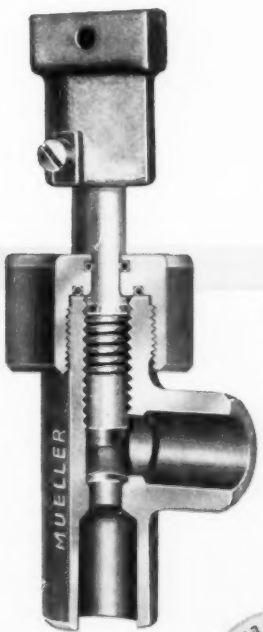


H-17650 VALVE TEE

Installed under pressure.
Valve seats in "closed" position and back-seats in "open" position.
Differential threads develop powerful seating force.
Make stop-off with screw driver and wrench.
Renew valve seat under pressure.
Activated with "E-4", "EH-1", "D-4", "DH-2" or "T" Machines.
Welding or threaded inlets.
Welding, threaded, Dresser or insulating outlets.
Cast iron cap for pressures to 250 P.S.I.
Steel cap and "O" ring seal for pressures to 1200 P.S.I.
Outlet sizes from ¾" through 2".



H-17800 CURB VALVE TEE

Installed under pressure.
Stem seats in "closed" position and back-seats in "open" position.
Operate from above-ground through curb box.
Silicon-bronze or stainless steel stems.
Renew valve seat under pressure.
Activated with "E-4", "EH-1", "D-4" or "DH-2" Machines.
Welding or threaded inlets.
Welding, threaded, Dresser or insulating outlets.
"O" ring stem and cap seals.
For pressures to 1200 P.S.I.
Outlet sizes from 1" through 2½".

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11	−A+B
02	A×B
12	−A×B
22	A+B

The address in the memory will be identified by decimal numbers starting with 11. If the address is followed by .0, it means that the stored number shall include the sign. If the address is followed by .1, it means that the number will be stored without sign.

Certain other details of the computer we have in mind are as follows:

1. Computer will handle the decimal properly including storing it.

2. Computer will handle plus and minus signs properly including storing them with the numbers if so instructed.

3. Memory unit will release the information about a number from storage without erasing the number.

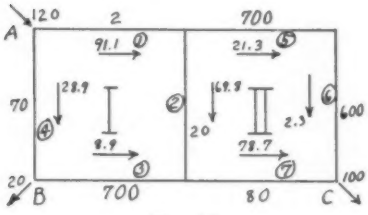


Fig. 16

4. Sending a number into storage at any memory address will erase information previously stored at that address.

In *Fig. 18*, we have reproduced the information in *Fig. 12* which showed the initial calculation by the manual Hardy Cross method. Before we present the program, there are several conventions to be used which are different than previously used. Flows to the right and down are considered positive. Flows to the left and up are considered negative. The pipe sections, on the bottom and left of a loop, such as 3, 7, 4, and 2, are class II pipe sections. You will notice that pipe section 2 is Class I with respect to Loop I, but Class II with respect to Loop II. The class of pipe section is used in two ways. First, when taking the Q to multiply it by the QR to obtain the product Q^2R, if the flow is in a Class I pipe section, the sign remains the same. If it is in a Class II pipe section, the sign is reversed. Second, the correction factor (Δ) is subtracted from the previous flow in the case of Class I pipe sections, while it is added in the case of Class II pipe sections.

The program for the computer we have described which will enable it to solve the network shown in *Fig. 18* is presented in *Fig. 19*. The cards would be punched out as shown in this program, and when these cards are fed into the computer, it would solve the network.

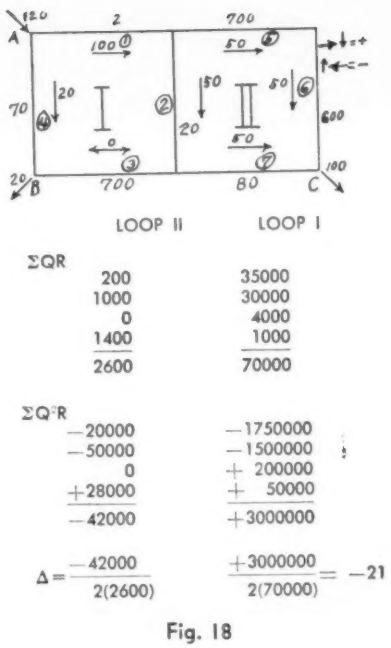


Fig. 18

There is nothing mysterious about programming a digital computer to solve a network problem. All that is necessary is a knowledge of the computing machine and some tedious, exacting work. But once having established the program for any network, it may be used for future problems with only slight modification. Also, it serves as a pattern for other networks which makes the writing of succeeding programs much easier. Any ex-

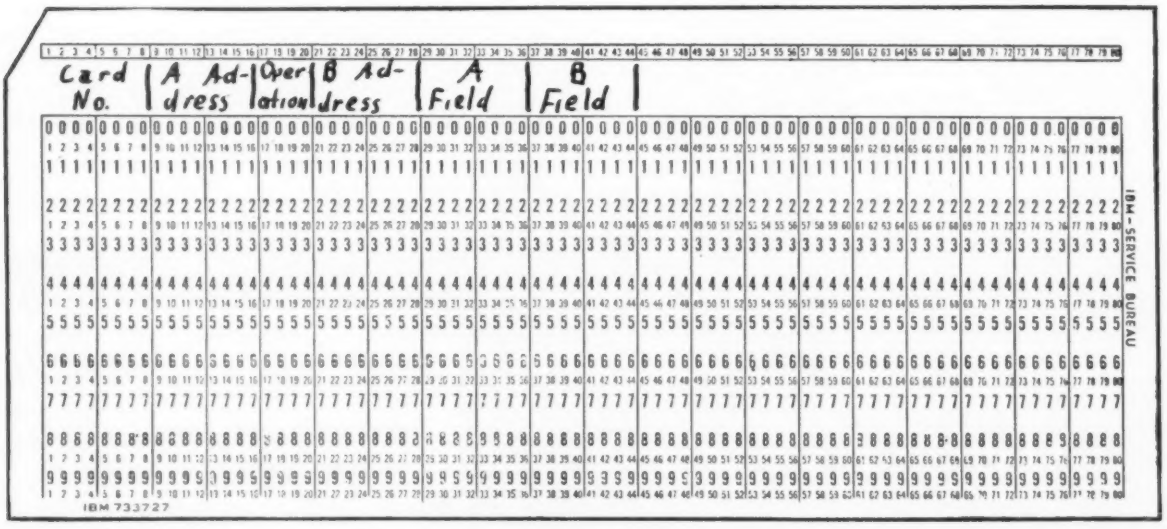


Fig. 17

LOOP I								LOOP II						
Card No.	A Address	Operation	B Address	C Address	A Field	B Field	REMARKS	Card No.	A Address	Operation	B Address	C Address	A Field	B Field
01		01		11.1	2.0	0.0	Add R_1 [R_5]* in A-Field to Zero in B-Field and Store w/o Sign	101		01		111.1	700.0	0.0
02		01		12.1	20.0	0.0	Ditto R_2 [R_6]	102		01		112.1	600.0	0.0
03		01		13.1	700.0	0.0	Ditto R_3 [R_7]	103		01		113.1	80.0	0.0
04		01		14.1	70.0	0.0	Ditto R_4 [R_8]	104		01		114.1	20.0	0.0
05		01		21.0	+100.0	0.0	Add Q_1 [Q_5] in A-Field to Zero in B-Field and Store w/ Sign	105		01		121.0	+50.0	0.0
06		01		22.0	+50.0		Ditto Q_2[Q_6]	106		01		122.0	+50.0	0.0
07		01		23.0	0.0	0.0	Ditto Q_3 [Q_7]	107		01		123.0	+50.0	0.0
08		01		24.0	+20.0	0.0	Ditto Q_4 [Q_8]	108		01		124.0	+20.0	0.0
09	11	02	21	31.1			Multiply Number in 11 (R_1) [111 (R_5)] by Number in 21 (Q_1) [121 (Q_5)] and Store w/o Sign	109	111	02	121	131.0		
10	12	02	22	32.1			Ditto R_2 Q_2 [R_6 Q_6]	110	112	02	122	132.0		
11	13	02	23	33.1			Ditto R_3 Q_3 [R_7 Q_7]	111	113	02	123	133.1		
12	14	02	24	34.1			Ditto R_4 Q_4 [R_8 Q_8]	112	114	02	124	134.1		
13	31	01	32	41.1			Add Number in 31 (R_1 Q_1) [131 (R_5 Q_5)] to Number in 32 (R_2 Q_2) [132 (R_6 Q_6)] and Store w/o Sign	113	131	01	132	141.1		
14	33	01	34	42.1			Ditto 33 (R_3 Q_3) [133 (R_7 Q_7)] and 34 (R_4 Q_4) [134 (R_8 Q_8)]	114	133	01	134	142.1		
15	41	01	42	43.1			Ditto 41 [141] and 42 [142] to give ΣRQ in 43 [143]	115	141	01	142	143.1		
16	21	02	31	51.0			Multiply Number 21 (Q_1) [121 (Q_5)] by Number in 31 (R_1 Q_1) [131 (R_5 Q_5)] and Store w/ Sign	116	121	02	131	151.0		
17	22	02	32	52.0			Ditto 22 (Q_2) [122 (Q_6)] and 32 (R_2 Q_2) [132 (R_6 Q_6)]	117	122	02	132	152.0		
18	23	12	33	53.0			Change Sign of Number in 23 (Q_3) [123 (Q_7)] Multiply by Number in 33 (R_3 Q_3) [133 (R_7 Q_7)] and Store w/ Sign	118	123	12	133	153.0		
19	24	12	34	54.0			Ditto 24 (Q_4) [124 (Q_8)] and 34 (R_4 Q_4) [134 (R_8 Q_8)]	119	124	12	134	154.0		
20	51	01	52	61.0			Add Number in 51 (R_1 Q_1^2) [151 (R_5 Q_5^2)] to Number 52 (R_2 Q_2^2) [152 (R_6 Q_6^2)] and Store w/ Sign	120	151	01	152	161.0		
21	53	01	54	62.0			Ditto 53 (R_3 Q_3^2) [153 (R_7 Q_7^2)] and 54 (R_4 Q_4^2) [154 (R_8 Q_8^2)]	121	153	01	154	162.0		
22	61	01	62	63.0			Ditto 61 [161] and 62 [162] to give ΣRQ^2 in 63 [163]	122	161	01	162	163.0		
23	43	02		71.0	2.0		Multiply Number in 43 (RQ) [143] by Number in A-Field and Store w/ Sign	123	143	02		171.0	2.0	
24	63	22	71	72.0			Divide Number in 63 [(ΣRQ^2) 163] by Number in 71 (ERQ) [171] and w/ Sign	124	163	22	171	172.0		
25	72	11	21	21.0			Subtract Number in 72 (Δ) [172] from Number in 21 (Q_1) [121 (Q_5)] and Store w/ Sign	125	172	11	121	121.0		
26	72	11	22	22.0			Ditto 22 (Q_2) [122 (Q_6)]	126	172	11	122	122.0		
27	72	01	23	23.0			Add Number in 72 (Δ) [172] to Number in 23 (Q_3) [123 (Q_7)] and Store w/ Sign	127	172	01	123	123.0		
28	72	01	24	24.0			Ditto 24 (Q_4) [124 (Q_8)]	128	172	01	124	124.0		

SKIP CARDS ENDING IN 01 TO 08 INCLUSIVE AND REPEAT AS MANY TIMES AS NECESSARY TO OBTAIN DESIRED ACCURACY

Fig. 19

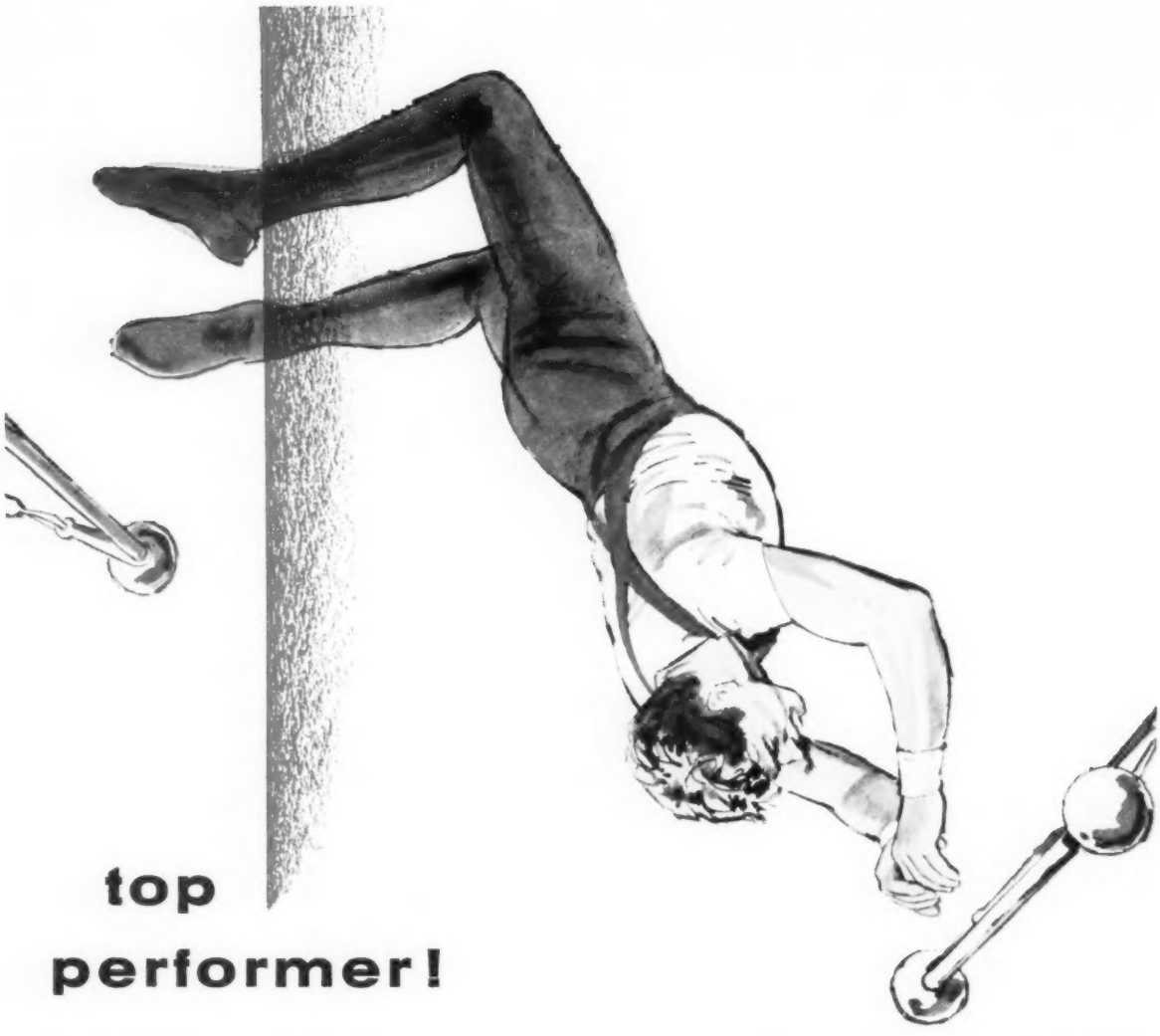
perienced programmer could produce a more efficient program than the one illustrated here. The author was associated with the solution of a network consisting of about 195 loops, 725 pipe sections, 350 loads, and 13 sources, using a large capacity digital computer. After conversion of the data from decimal to binary numbers, the solution was obtained in 24 minutes.

Another way in which the network may be solved is by an analog computer. Such a computer is one in which the various elements of a problem are simulated by some other means. That is, a model of the problem is constructed, and from it the desired solutions are obtained. The model may have no physical resemblance to the problem or the structures involved in the problem. The most common analog computers are those in which electrical elements represent the various components. Such analogs are widely used for solving many different problems, such as stresses and strains in mechanical devices, trajectories of projectiles, and so forth.

The common AC or DC network calculator is an analog computer where the various elements of the electrical transmission or distribution systems are represented by suitable electrical elements. The calculation of the flows in an electrical network with direct current electricity is a straight-forward matter, and for many years electrical engineers have used such calculators to solve such problems.

However, when the pressure drop is not in direct relationship to the flow, but rather is in some relationship such as a power greater than 1, the solution is not straightforward. Thus in the case of water or gas where the pressure flow relationship is expressed by the formula $H=KQ^x$ where x is greater than 1, expedients must be used.

The first work along this line with which the author is familiar was conducted at the Illinois Institute of Technology by J. P. Clennon and J. K. Dawson. They were interested in solving gas networks and devised a method by which the solution could be obtained with the use of a DC network calculator. Their method involves a series of adjustments made by a prescribed routine which results in an answer accurate enough for engineering purposes. An example of a problem solved by the Clennon-Dawson



top performer!

Cast iron pipe keeps setting new highs for long life, dependability, economy. Literally hundreds of America's leading gas companies are still using cast iron gas mains installed over fifty years ago. Fifty five are still going strong with mains that have served a century or longer. And today's modernized cast iron pipe, centrifugally cast, is even stronger, more durable, more uniform.

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- Joint design allows for deflection during and after installation.
- Service connections are easily made.
- Long life a matter of record.
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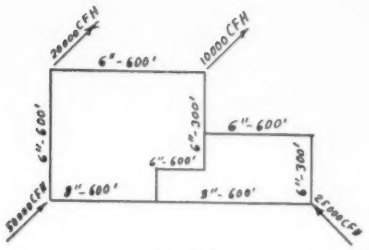

Fig. 20

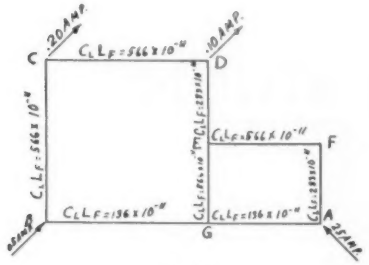

Fig. 21

method is shown below, being taken from their paper "Gas Distribution Problems Solved by Electric Network Calculators," presented before the American Gas Association in April 1951.

Fig. 20 illustrates the gas system under study.

Fig. 21 shows the schematic electrical setup. Proper conversion factors must be used between voltage and gas pressure and between current flow and gas flow together with proper sizing of resistances so that the data may be brought within the range of the equipment being used. The factor C_1L_F takes into account the length and size of each pipe section, the gas flow formula being used, and the units being used, etc., so that when it is multiplied by Q^2, it will truly give the pressure drop. It is common to make the initial value of the resistance which represents a pipe section proportional to the C_1L_F factor.

Having determined the conversion factors, the values of the resistances, and input and output currents, the network analyzer is set up: that is, appropriate connections are made so that the elements in the calculator will be connected as schematically shown in *Fig. 21*.

Having set up the board as indicated above, the current flows are read and recorded as I_1. The resistance units are now readjusted in proportion to the product of the current flow and the factor C_1L_F and recorded as R_2. Current inputs are readjusted and the currents in each branch read and recorded as I_2. Im_1 is then calculated being the mean value of I_1 and I_2. Again the resistances are adjusted in proportion to the product of Im_1 and the factor C_1L_F and recorded as R_2. This process is repeated until satisfactory accuracy is obtained which will be indicated when the recorded value of I is close to the Imn value just calculated.

The observed current flows are then converted to gas flows and voltage drops converted to pressure drops.

Other work has been done in this field along similar lines, but with a view to simplifying the calculations or adjustments required.

Professor McIlroy of Cornell University developed an analog device for flows in fluid networks. He perfected a vacuum tube element called "Fluistor," in which the voltage drop across the tube is proportional to a power of the current flowing.* It is possible to have this power of various values, but a common power is 1.85. This power is commonly used in calculating head losses in water systems and is close enough to the power 2 commonly used for that purpose. With such a used in gas flows so that it may be

Conversion of Measured Values To Actual Values

Current Flow — Gas Flow

Branch	Current Flow	Conversion Factor	Gas Flow CFH
B-C	0.139	1.0×10^5	13,900
C-D	0.059	"	5,900
B-G	0.090	"	9,000
G-E	0.072	"	7,200
E-D	0.158	"	15,800
A-G	0.160	"	16,000
A-E	0.087	"	8,700

Voltage Drop — Pressure Drop

Location	Potential	Potential Change	Conversion Factor	Pressure Inches Water Column
C	0.848			4.00
A	1.000	0.152	1.0 x 10	5.52
B	0.956	0.108	"	5.08
C				
D	0.867	0.019	"	4.19
E	0.938	0.09	"	4.90
G	0.966	0.118	"	5.11

Fig. 23

Fluistor, the gas or water system may be directly represented by the analog computer and results obtained directly without a series of corrections.

Summing up, the method used in determining the distribution of flows in a network will depend upon the circumstances prevailing in different situations. If only a small network is to be solved occasionally, probably the manual method or the Hardy Cross method would be the most suitable. If, on the other hand, a large number of large networks must be solved frequently, probably the solution would best be by analog or digital computer. Other factors, such as the size of the organization, the number of engineers, and facilities available, will also influence the choice of method. ■

* American Gas Association Monthly, September, 1953, page 19.

REFINEMENT OF BALANCE

Branch	C_1L_f	R_1	I_1	R_2	I_2	$I_{m}1$	R_3	I_3	$I_{m}2$	R_4	I_4
B-C	566×10^{-11}	0.566	0.155	0.876	0.120	0.137	0.775	0.140	0.138	0.780	0.139
C-D	566×10^{-11}	0.566	0.041	0.237	0.076	0.058	0.328	0.057	0.057	0.325	0.059
B-G	136×10^{-11}	0.136	0.103	0.141	0.072	0.087	0.119	0.091	0.089	0.122	0.090
G-E	566×10^{-11}	0.566	0.069	0.390	0.073	0.071	0.402	0.070	0.070	0.399	0.072
E-D	283×10^{-11}	0.283	0.141	0.399	0.175	0.158	0.447	0.156	0.157	0.445	0.158
A-G	136×10^{-11}	0.136	0.175	0.239	0.142	0.158	0.216	0.160	0.159	0.217	0.160
A-E	849×10^{-11}	0.849	0.073	0.619	0.101	0.087	0.739	0.088	0.087	0.743	0.087

Fig. 22

A scientifically made, and properly used, analysis of past years' weather conditions appears to be one of the best answers to the problems of planning for the future in a weather-affected business, such as the gas industry.

Increasing profits by weather engineering studies

By WALTER H. ROSCHKE JR.
Weather Corp of America, St. Louis

THERE is "something new" in the field of weather for the gas industry.

The weather engineering study, a product of the industrial meteorologist, is a little understood service which offers great potentials for the gas industry.

Weather engineers can develop the facts necessary for optimum economical long-range planning of system capacity, supply and operations.

A weather study provides a complete set of weather facts for any operational-weather decision, minimizing such risks through a knowledge of the "weather gamble."

Actually, gas companies—pipelines and distributors—were among the first to make use of industrial meteorology in the form of specific forecasts issued to meet their varied daily load requirements. However, very few weather engineering studies have been made in the gas field.

The weather engineering study is significant in that it is "timeless"—representing a one-time investment which is just as useful 10 years from now as it is today.

Such studies are particularly useful to the smaller utility which may not require the interpretive forecasting service.

Knowing about the weather, about its history, about its probabilities, about what the future may hold based on a known past of weather occurrences, can help in a wide range of decisions, such as the economics of the development of peak shaving, or stand-by capacity; the development of additional space heating and interruptible loads, and by giving the weather gamble in any operational weather problem.

Weather Corp. of America provides two major services for gas companies:

1. Operational short-range forecasting, interpret-

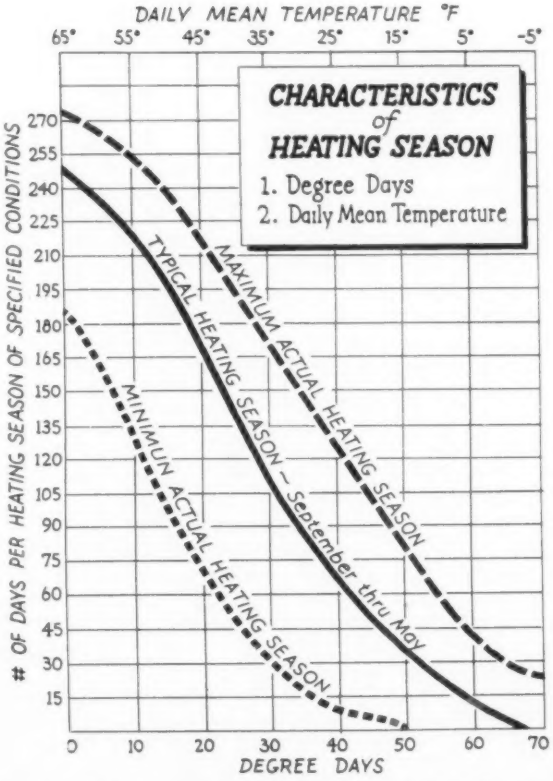
DAILY MEAN TEMPERATURE °F
65° 55° 45° 35° 25° 15° 5° -5°
CHARACTERISTICS of HEATING SEASON
1. Degree Days
2. Daily Mean Temperature
OF DAYS PER HEATING SEASON OF SPECIFIED CONDITIONS
270 255 240 225 210 195 180 165 150 135 120 105 90 75 60 45 30 15
MAXIMUM ACTUAL HEATING SEASON
TYPICAL HEATING SEASON — September thru May
MINIMUN ACTUAL HEATING SEASON
0 10 20 30 40 50 60 70
DEGREE DAYS

Fig. 1. Graph shows number of days that a certain daily mean temperature, or a lower value, can be expected during typical 273-day heating season of Sept. 1-May 31. For example, daily mean temperature of 30 degrees F or less (or 35 degree day, or more) can be expected to occur on 90 days in this period.

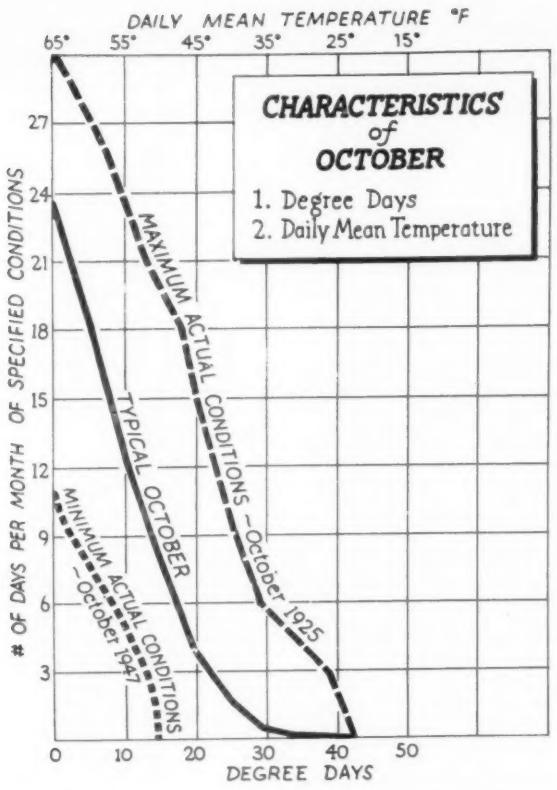
DAILY MEAN TEMPERATURE °F
65° 55° 45° 35° 25° 15°
CHARACTERISTICS of OCTOBER
1. Degree Days
2. Daily Mean Temperature
OF DAYS PER MONTH OF SPECIFIED CONDITIONS
27 24 21 18 15 12 9 6 3
MAXIMUM ACTUAL CONDITIONS —October 1925
TYPICAL OCTOBER
MINIMUM ACTUAL CONDITIONS —October 1947
0 10 20 30 40 50
DEGREE DAYS

Fig. 2. Typical October is characterized by daily mean temperature of 55 degrees F, or less (or 10 degree days, or more) on about 13 days, while the warmest October (1947) had only five days and coldest (1925) was accompanied by 24 days of this temperature characteristic.

ing weather conditions in terms of specific conditions.

2. Engineering studies, where weather history is analyzed to predict future probabilities, and to pinpoint the weather factors which affect a gas company's operations.

How are weather engineering studies made?

A complete weather history is recorded in the Weather Corp.'s microfilm files, or is available for IBM sorting and analysis. The engineers study in detail the weather conditions as they affect the individual gas company in the specific area or locale in which the firm is located.

They determine how the gas company's operation varies with the weather (the ratio, for example, by which gas demands vary with the temperature).

The engineers determine the risk and the odds involved. They answer specific questions such as "how many new customers can be added?" "can a new interruptible customer be added economically?" etc.

There are three distinct areas where weather engineering studies will directly benefit gas utilities: (1) design, (2) operational controls, (3) operational gambles.

Let's take a look at these three areas and see the purpose of weather studies, how they're made, how they can help, and, later, illustrations of how these types of studies have aided in other fields.

TABLE 1. Characteristics of October for degree days and daily mean temperature. Data compiled from analysis of Springfield, Ill. for 1907 through 1956.

Number of Degree Days	Daily Mean Temperature °F	Number of Occurrences in a 50-Year Period	Accumulated Frequency of Occurrence in 50 Years	Avg. No. of Days With Daily Mean Temperature Equal to, or Less Than, a Certain Value
43	22	2	2	.04 (occurs once every 25 yrs.)
42	23	0	2	.04
41	24	0	2	.04
40	25	0	2	.04
39	26	1	3	.06 (occurs once every 16 yrs.)
38	27	0	3	.06
37	28	0	3	.06
36	29	0	3	.06
35	30	0	3	.06
34	31	0	3	.06
33	32	3	6	.12 (occurs once every 8 yrs.)
32	33	4	10	.20 (occurs once every 5 yrs.)
31	34	6	16	.32 (occurs once every 3 yrs.)
30	35	4	20	.40
29	36	14	34	.68
28	37	4	38	.76
27	38	17	55	1.10 (occurs about once each October)
26	39	7	62	1.24
25	40	27	89	1.78
24	41	11	100	2.00
23	42	25	125	2.50
22	43	18	143	2.86
21	44	38	181	3.62
20	45	11	192	3.84
19	46	47	239	4.78
18	47	26	265	5.30
17	48	51	316	6.32
16	49	20	336	6.72
15	50	69	405	8.10
14	51	24	429	8.58
13	52	62	491	9.82
12	53	36	527	10.54
11	54	71	598	11.95
10	55	35	633	12.66
9	56	79	712	14.24
8	57	36	748	14.96
7	58	75	823	16.46
6	59	23	846	16.92
5	60	93	939	18.78
4	61	30	969	19.38
3	62	87	1056	21.12
2	63	34	1090	21.80
1	64	71	1161	23.22
0	65	27	1188	23.76
	66	77	1265	25.30
	67	28	1293	25.86
	68	56	1349	26.98
	69	21	1370	27.40
	70	50	1420	28.40
	71	17	1437	28.74
	72	37	1474	29.48
	73	18	1492	29.84
	74	30	1522	30.44
	75	5	1527	30.54
	76	11	1538	30.76
	77	3	1541	30.82
	78	7	1548	30.96
	79	0	1548	30.96
	80	0	1548	30.96
	81	0	1548	30.96
	82	0	1548	30.96
	83	1	1549	31.00

• 1. Weather study to assist in engineering design

The purpose of this type of study is to provide the weather facts necessary for optimum economical long-range planning of system capacity, supply and

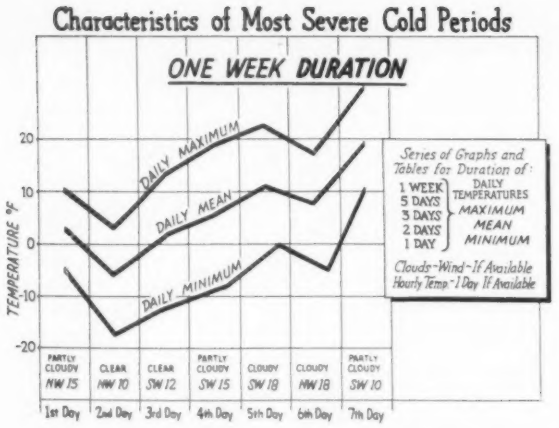

Fig. 3. For a given duration, such as one week, vital data affecting space heating load are presented, such as daily mean temperature and daily minimum and maximum temperatures (also daily wind and cloud conditions if available).

operations. In other words, planning for building for the future.

What does such a study contain?

It includes such things as the temperature characteristics of the typical heating season (Sept. 1-May 31), emphasizing the number of days per heating season with daily mean temperatures equal to, or less than, a specified value (*Fig. 1*); the temperature characteristics of each month of the heating season (*Fig. 2 and Table 1*); the temperature characteristics of the actual coldest and warmest occurrence of each month of the heating season; the temperature, wind, and cloud conditions associated with the most severe cold outbreaks in history of specified durations (one week, five, three, two or one day) (*Fig. 3*).

Such engineering studies are of real value to the gas engineer in the (a) economic evaluation of the development of additional peak shaving (and standby) capacity through holders, propane-air equipment, or underground storage and (b) economic evaluation of adding additional interruptible and space heating loads.

In planning for the future, it is necessary to know the extremes which may occur in order to prepare for the maximum, and to be certain that equipment and operations can meet the highest demands that can be placed on the system.

These studies enable a gas utility to plan correctly and economically — to eliminate overplanning and underplanning.

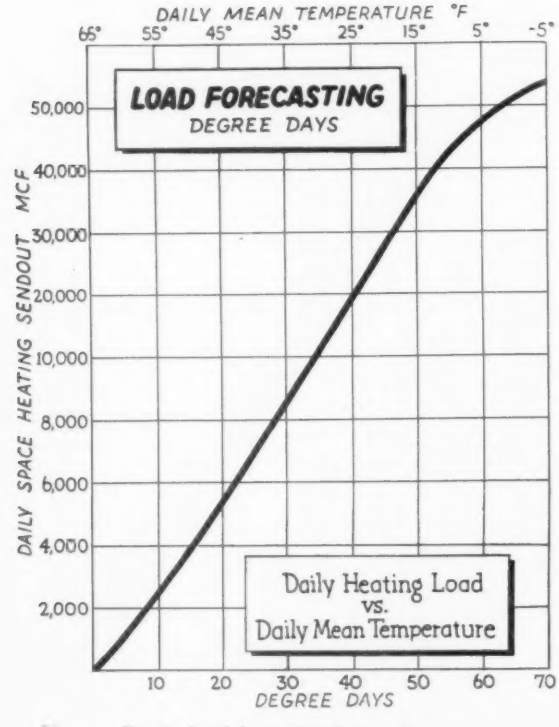

Fig. 4. Load forecasting-degree days.

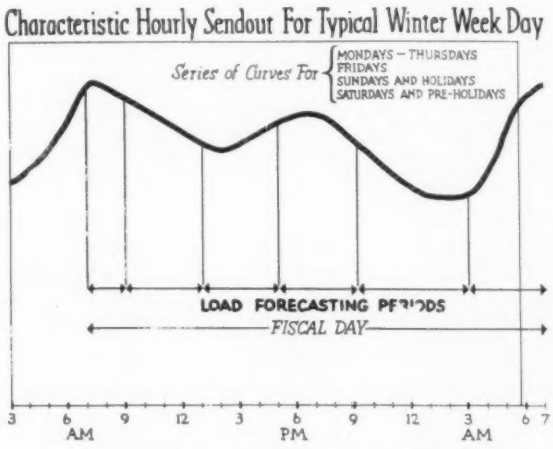

Fig. 5. Characteristic hourly sendout for typical winter week day.

• 2. Weather study for operational controls and development purposes

The purpose of this type of study is to increase the operational efficiency of a gas utility through better control of daily space heating loads.

It contains the relationship of total space heating loads to degree days, or daily mean temperatures (*Fig. 4*). It also contains refinement of space heating load control procedures by analyzing customers' daily and weekly habits, the effects of temperature, the effects of wind, and the effects of cloud cover (*Fig. 5*).

Better load control procedures are of real economic value to the distribution company in avoiding contract demand penalties, and proper scheduling of peak-shaving operations and interruptible loads

• 3. The operational-weather gamble study

The purpose of such an engineering study is to provide the complete weather facts for any operational-weather affected decision, and to minimize such risks through a knowledge of weather gambles.

Here is a quality product! This is an actual close-up photograph of a black U-Brand malleable iron pipe fitting—coated with Union Malleable's exclusive U-Cote, a transparent, rust resistant coating which gives you more fitting—at no extra cost. All U-Brand fittings, both black and galvanized, are constantly subjected to rigid quality controls and individual inspections.

Why not "specify U-Brand" the next time you order from your wholesaler? Your own tests will prove "It's more fitting."

For increased customer satisfaction,

stock and sell U-Brand fittings.

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MANUFACTURING COMPANY
ASHLAND, OHIO

A single source for all your pipe fitting needs Galvanized and Black U-Cote Malleable Iron Pipe Fittings—Unions—Plugs and Bushings—Cast Iron Drainage and Screwed Fittings—Steel Nipples and Couplings—Metal Insert Fittings for Plastic Pipe.

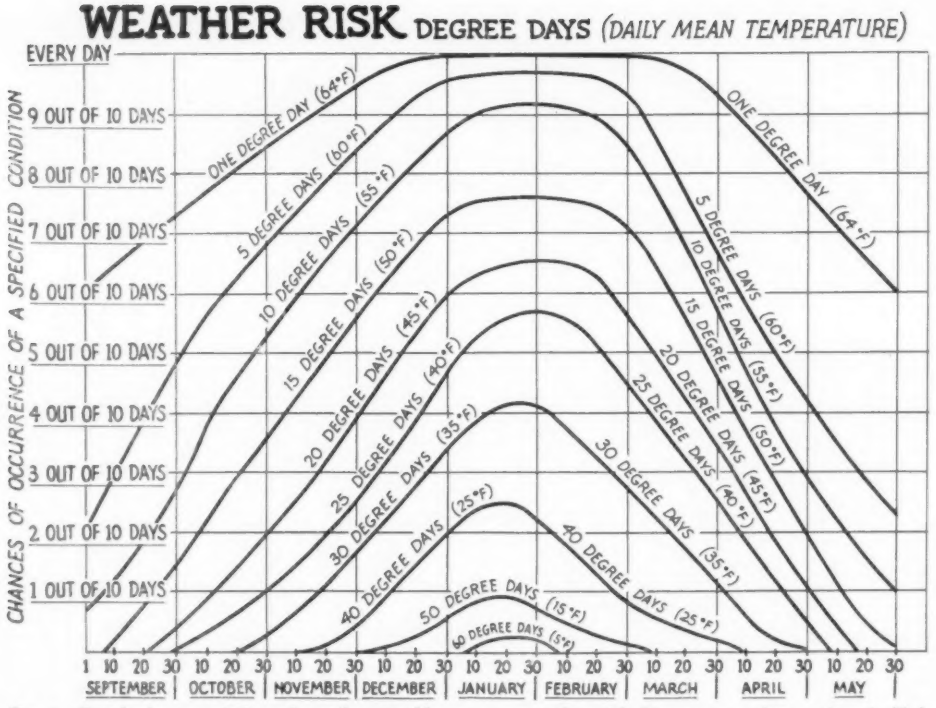

WEATHER RISK DEGREE DAYS (DAILY MEAN TEMPERATURE)
CHANCES OF OCCURRENCE OF A SPECIFIED CONDITION
EVERY DAY
9 OUT OF 10 DAYS
8 OUT OF 10 DAYS
7 OUT OF 10 DAYS
6 OUT OF 10 DAYS
5 OUT OF 10 DAYS
4 OUT OF 10 DAYS
3 OUT OF 10 DAYS
2 OUT OF 10 DAYS
1 OUT OF 10 DAYS
ONE DEGREE DAY (64°F)
5 DEGREE DAYS (60°F)
10 DEGREE DAYS (55°F)
15 DEGREE DAYS (50°F)
20 DEGREE DAYS (45°F)
25 DEGREE DAYS (40°F)
30 DEGREE DAYS (35°F)
40 DEGREE DAYS (25°F)
50 DEGREE DAYS (15°F)
60 DEGREE DAYS (5°F)
1 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30
SEPTEMBER OCTOBER NOVEMBER DECEMBER JANUARY FEBRUARY MARCH APRIL MAY

Fig. 6. Graph shows variation of weather gambles throughout heating season, emphasizing obvious seasonal variation in the chance of occurrence of colder days (more degree days) with a maximum in the mid-January period and a decrease in likelihood towards beginning and end of heating season. For example, a gas day with 30, or more, degree days is likely four out of 10 days during mid and late January, but day of such characteristics is only likely once out of 10 days in mid-November and early April, and has never occurred before mid-October or after end of April.

TABLE 2. Weather risk, showing number of days that a specified degree day value or a larger value (or the number of days that a specified daily mean temperature value, or a smaller value) is likely to occur during successive 10-day intervals of the heating season.

Ten-Day Interval:	DEGREE DAYS 1	5	10	15	20	25	30	40	50	60
Sept. 1 – 10	6.3	2.5	1.0	0	0	0	0	0	0	0
Sept. 11 – 20	6.6	3.3	1.6	0.5	0	0	0	0	0	0
Sept. 21 – 30	7.1	4.2	2.3	1.2	0.2	0	0	0	0	0
Oct. 1 – 10	7.4	5.2	3.2	1.8	0.6	0.4	0	0	0	0
Oct. 11 – 20	7.8	5.9	4.4	2.5	1.2	0.5	0	0	0	0
Oct. 21 – 30	8.2	6.4	4.9	3.2	1.6	0.8	0.1	0	0	0
Oct. 31 – Nov. 9	8.6	7.0	5.6	3.8	2.4	1.2	0.4	0	0	0
Nov. 10 – 19	8.9	7.5	6.2	4.5	2.8	1.6	0.9	0.1	0	0
Nov. 20 – 29	9.2	8.0	6.8	5.2	3.6	2.2	1.4	0.2	0	0
Nov. 30 – Dec. 9	9.6	8.6	7.4	5.8	4.3	2.8	1.8	0.6	0	0
Dec. 10 – 19	9.8	9.1	7.9	6.5	5.0	3.5	2.5	1.1	0.2	0
Dec. 20 – 29	9.9	9.4	8.4	7.1	5.7	4.2	3.1	1.7	0.4	0
Dec. 30 – Jan. 8	9.9	9.6	8.9	7.5	6.1	5.0	3.6	2.2	0.7	0
Jan. 9 – 18	9.9	9.7	9.2	7.6	6.4	5.4	4.1	2.5	0.9	0.2
Jan. 19 – 28	9.9	9.7	9.2	7.6	6.5	5.7	4.2	2.4	0.8	0.2
Jan. 29 – Feb. 7	9.9	9.7	9.2	7.6	6.5	5.6	3.7	1.8	0.5	0
Feb. 8 – 17	9.9	9.7	9.1	7.6	6.5	5.4	3.5	1.6	0.4	0
Feb. 18 – 27	9.9	9.5	8.8	7.4	6.0	4.8	2.9	1.0	0.2	0
Feb. 28 – Mar. 9	9.9	9.0	8.1	6.8	5.2	4.1	2.5	0.5	0.1	0
Mar. 10 – 19	9.8	8.1	7.3	6.0	4.5	3.5	2.0	0.4	0	0
Mar. 20 – 29	9.6	7.2	6.3	5.0	3.7	2.8	1.5	0.3	0	0
Mar. 30 – Apr. 8	9.1	6.2	5.1	4.0	3.0	2.2	0.9	0.1	0	0
Apr. 9 – 18	8.6	5.3	4.2	3.3	2.2	1.5	0.3	0	0	0
Apr. 19 – 28	8.0	4.6	3.3	2.5	1.4	0.8	0.1	0	0	0
Apr. 29 – May 8	7.4	3.8	2.6	1.6	0.7	0.2	0	0	0	0
May 9 – 18	6.8	3.2	1.8	0.8	0.1	0	0	0	0	0
May 19 – 28	6.3	2.6	1.2	0.2	0	0	0	0	0	0
	64°	60°	55°	50°	45°	40°	35°	25°	15°	5°
	DAILY MEAN TEMPERATURE									

As it pertains to a gas company, this study contains, for example, the weather risk for successive 10-day intervals during the heating season, emphasizing the chance of occurrence of a specified degree day value, or a larger value (or a specified daily mean temperature or a smaller value) during each 10-day interval (*Fig. 6 and Table 2*).

It also tells the gas company of the weather risk for any special weather condition of operational importance during any period of the heating season, such as the chance of occurrence of three consecutive days with 30, or more, degree days (*Fig. 7*).

The detailed, exacting and sometimes involved work of weather consultants in this type of weather-risk study offers a gas company better planning of peak-shaving inventory levels during any period of the heating season and a knowledge of the risk involved in any type of operation where decisions are affected by the weather.

Since no two weather problems are precisely alike, each weather engineering study is made to aid in the solution of a specific problem.

To illustrate some of the weather problems which have been brought to solution by weather engineering studies, here are a few examples:

Cities Service Gas Co. had applied to the Federal Power Commission for a rate increase, contending that it was unable to receive a fair profit from its operations the year before. The commission said the company could get along without the rate increase because the weather that year had been warmer than 'normal," and that the prospect was for more "normal" weather and a corresponding increase in gas sales volume.

Cities Service came to Weather Corp. with the problem: What is a realistic appraisal of the word "normal"?

Weather Corp. found the word "normal" led to misunderstanding; that, by studying 30 years of weather history, the commission's "normal" had never occurred and was not likely to, and that accurate gas sales analysis should be based on monthly, not yearly data.

A detailed and involved study was completed for the U. S. Army Quartermaster Corps whose duties included the testing of new clothing and equipment for all types of weather. Weather Corp.'s engineers were asked to establish characteristic weather patterns for areas around the world. It was found, for example, that the general climate of Key West, Fla., could be established accurately by studying only 14 years of weather history, but it took 31 years to establish a pattern in Cheyenne, Wyo.

Weather, then, can be engineered for profit. The weather engineering study provides the gas executive with all the weather facts necessary for optimum, economical, long-range planning of system capacity, supply and operations. ■

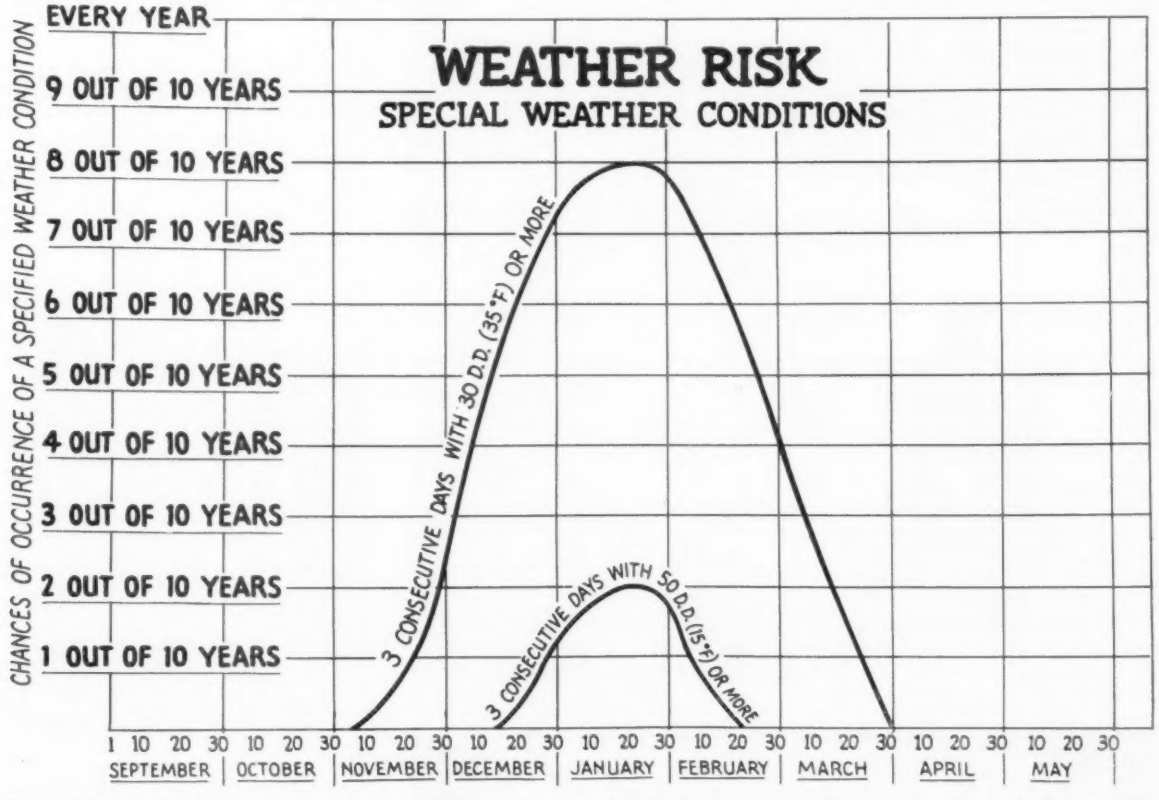
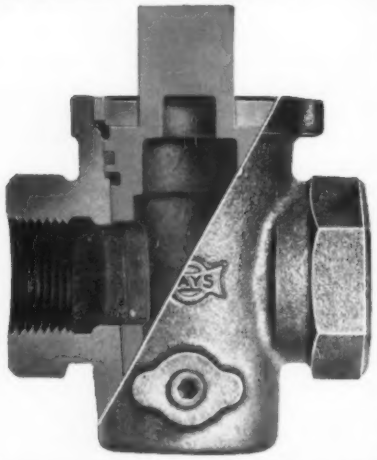

WEATHER RISK
SPECIAL WEATHER CONDITIONS
CHANCES OF OCCURRENCE OF A SPECIFIED WEATHER CONDITION
EVERY YEAR
9 OUT OF 10 YEARS
8 OUT OF 10 YEARS
7 OUT OF 10 YEARS
6 OUT OF 10 YEARS
5 OUT OF 10 YEARS
4 OUT OF 10 YEARS
3 OUT OF 10 YEARS
2 OUT OF 10 YEARS
1 OUT OF 10 YEARS
3 CONSECUTIVE DAYS WITH 30 D.D. (35°F) OR MORE
3 CONSECUTIVE DAYS WITH 50 D.D. (15°F) OR MORE
1 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY

Fig. 7. Graph shows that three consecutive days with 30 or more degree days is likely eight out of 10 years in mid and late January, but only likely one out of 10 years in late November and March. Similar determinations can be made about any special weather condition which requires an operation weather affected decision.

THIS GAS STOP WILL *NOT STICK...*

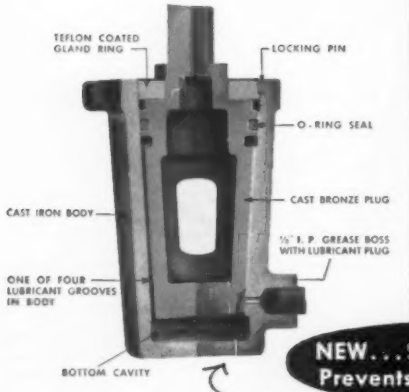


- A newly designed HAYS Lubricated and Tamper-Proof Gas Stop . . .
- Stop is completely lubricated at the factory . . .
- Four Grooves in body, and Lubricant Plug provide for pressure re-lubrication . . .
- Locking Pin positively prevents tampering at top of stop . . .
- O-Ring prevents top leakage . . .
- Teflon Coated Gland Ring reduces friction between top of plug and gland ring...

Re-Lubrication does the *TRICK*

HAYS

LUBRICATED TAMPER-PROOF SAFETY GAS STOP*



- Lower initial and turning torque . . .
- Extra grade gray iron body, gas service bronze plug . . .
- Individually tested . . .
- Black or Galvanized, Flat Head or Lockwing Pattern...
- Sizes: ¾", 1", 1¼", 1½", 2", for 125 psi. W. P.

Write for Folder 121 and prices.

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NEW... Solid Bottom Construction Prevents Leakage and Tampering

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GAS NEWS

Atlanta completes Cobb county line

Atlanta (Ga.) Gas Light Co. has completed its $500,000 construction project to increase gas delivery to neighboring Cobb county.

The 24-in. line runs over 3.8 miles of hilly terrain and under the Chattahoochee river. Two 20-in. lines were run under the river. At the crossing, lines were laid a minimum of 7 ft beneath the river bed. Some of the slopes were so steep that the digging machine had to be held back by cables.

A 16-in. line, serving Cobb county since 1930, will remain in service. The new river crossing lines replace four 8-in. lines formerly used.

During the past 10 years, customers served by Atlanta Gas in Cobb county increased from 3447 to 16,955.

In addition to increasing Cobb county deliveries, the new line also will aid in serving gas to the northwest section of Atlanta and to the power generating plant on the Chattahoochee river.

Work has now been completed on this 24-in. line of Atlanta Gas Light. The increased gas capacity for Cobb county is part of the $8.2 million expansion the company had under way this year.

Stabilize field prices and capital costs, says expert

Consumption of natural gas will grow at a pace faster than the nation's 5 to 7 per cent annual increase in energy requirements, according to William B. Poor, vice president of Ford, Bacon, and Davis Inc., New York. But, the industry must stabilize rising field prices and increasing capital construction costs.

"The problem is not one of demand but of supply," Mr. Poor said. "There is a distinct possibility that by 1963-64 large consuming areas . . . may face deficiencies warranting construction of at least four additional transmission lines of a magnitude of 1000 miles of 30-in. pipe each.

"Ample supply must be assured," he said, "since natural gas pipelines have always been built in direct ratio to proved reserves. But I do not see any problem here, either."

Mr. Poor said that even though off-shore fields are high in cost, and "economic and political pressure cloud the availability," of Canadian and Mexican gas, there are "very promising developments" in the Arkansas River basin in eastern Oklahoma and western Arkansas and "encouraging explorations" in southern Oklahoma's Anadarko basin and in Texas' Terrell county and Val Verde basin.

To capitalize on growing demand, the gas industry must stabilize prices at the field and stabilize the capital cost of transmission lines, he said.

While increased reserves will tend to stabilize field prices, Mr. Poor said the greatest progress has been made in cutting the cost of getting it to market.

"But the end is a long way off," he continued. ". . . It still costs about $4000 per inch diameter to lay a mile of pipe across normal terrain. And operating a line still costs 1.5 to 1.75 cents per Mcf per hundred miles."

So. Union extends lines

Southern Union Gas Co. is building pipeline facilities to bring gas to Milan, N. M. The project—consists of 6-, 4-, and 2-in. line—will cost more than $100,000.

When facilities are completed to Milan, Southern Union will bring gas service to about 200 homes and businesses, according to T. A. Wilson, Farmington district manager. By next spring an additional 300 homes are slated for construction,

Why Is RIDGID The World's Most Popular Pipe Wrench

...because it was a better pipe wrench when first created 35 years ago, and has been improved nearly every year since . . . in performance, design, materials. Today, it is still the most for your money. Buy RIDGID at your Supply House.

The Ridge Tool Company, Elyria, Ohio, U.S.A.

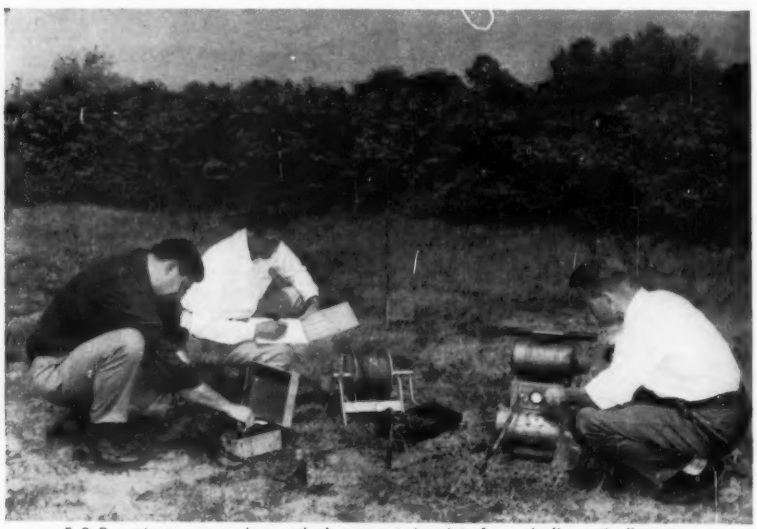
with a total of about 500 new homes contemplated within the next three years.

Engine standards revised by diesel engine group

The fifth edition of the DEMA Standard Practices for stationary diesel and gas engines has just been published.

Several significant developments in the engine field have occurred in recent years. Among the outstanding ones are the development of high compression gas engines, adaption of the diesel engine to burn low grade residual fuels, and new supercharging systems that have made it possible to operate engines at considerable higher altitudes, with sea level ratings. The chapters in the previous editions of the book have been enlarged and brought up to date to take into consideration these and other new developments.

Additional information about the book is available from the Diesel Engine Manufacturers Association, 200 K St. N. W., Washington 6, D. C. Cost: $5.00 per copy.



E. R. P. engineers use modern methods to get design data for a pipeline cathodic protection system. This group is making current requirement tests for designing a ground bed.

E.R.P. DESIGNS CATHODIC SYSTEMS
That Give Maximum Pipeline Protection

E. R. P. corrosion engineers are trained specifically in cathodic protection techniques. They evaluate all pertinent data *before* designing a pipeline cathodic system. *After* design and installation, continued E. R. P. surveys help maintain the efficiency of the system. They warn of environmental changes that affect complete protection.

Cathodic protection is, after all, like any tool. It requires skill and knowledge to use the tool successfully.

The cost of a cathodic system should always be measured by the savings achieved through maintaining full corrosion control, not just by the first cost of the system. On this basis E. R. P. designed cathodic systems give maximum savings for each dollar spent. For full information about E. R. P. cathodic protection for pipelines write for Bulletin E-43.41.

ERP CATHODIC PROTECTION SINCE 1935

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CABLE: ELECTRO, NEWARK, N. J.

New specifications cover mild steel electrodes

Changes in the specifications for mild steel electrodes are contained in a booklet prepared by the American Welding Society and the American Society for Testing Materials.

Major changes include (1) three new iron powder electrodes; (2) new E70 mild steel classification containing six electrode types; (3) listing certain electrodes in the E70 series as well as the E60; (4) addition of a new requirement; (5) inclusion of two new tables in the index.

Copies are available from the AWS, 33 W. 39th St., New York 18. Cost: 50 cents.

Buy appliances now, says homemaker congress

McCall's second annual Congress on Better Living revealed that women prefer buying a larger house not equipped with built-in appliances rather than a smaller house that was fully equipped.

Carrying this thought further, the 100 homemaker-delegates emphasized that they would prefer to buy their own appliances. Thus, they could more readily make their kitchens and laundries more functional than seemed to them possible in an appliance-equipped house.

Women felt that washers and dryers were no longer to be considered luxuries, but are necessary tools in the efficient operation of a home.

Price is not considered a prime factor when they purchase an appliance. But, they look to the features that will speed their work. This attitude toward price is the result of increasing confidence on the part of the delegates that the recession is over—at least in most parts of the country.

They feel that "now is the time to buy" major appliances. The vote to buy now was cast by 72 per cent of the delegates.

North Carolina Natural's financing plan okayed

North Carolina Natural Gas Co.'s plans for financing its operations in eastern North Carolina have been

approved by the State Utilities Commission.

The commission (1) approved sale of some $13.7 million in first mortgage pipeline bonds; (2) approved issuance of $12,500 in promissory notes; (3) authorized sale of $5.2 million in subordinated income debentures; and (4) approved sale of 540,000 shares of common stock.

North Carolina Natural will build a distribution system tying into the Transcontinental Gas Pipe Line Corp.'s Texas-to-New York line in Iredell county. It also will extend the distribution system to 22 southeastern and eastern North Carolina municipalities.

United Gas shows four kitchens at state fair

United Gas Corp. displayed four all-gas kitchens in the Natural Gas Building during the recent Louisiana State Fair in Shreveport.

One kitchen featured a complete line of RCA Whirlpool gas appliances, including two ice-maker refrigerators, two built-in ovens and broilers, three high-speed top burners and one burner-with-a-brain, an automatic washer and an automatic gas dryer.

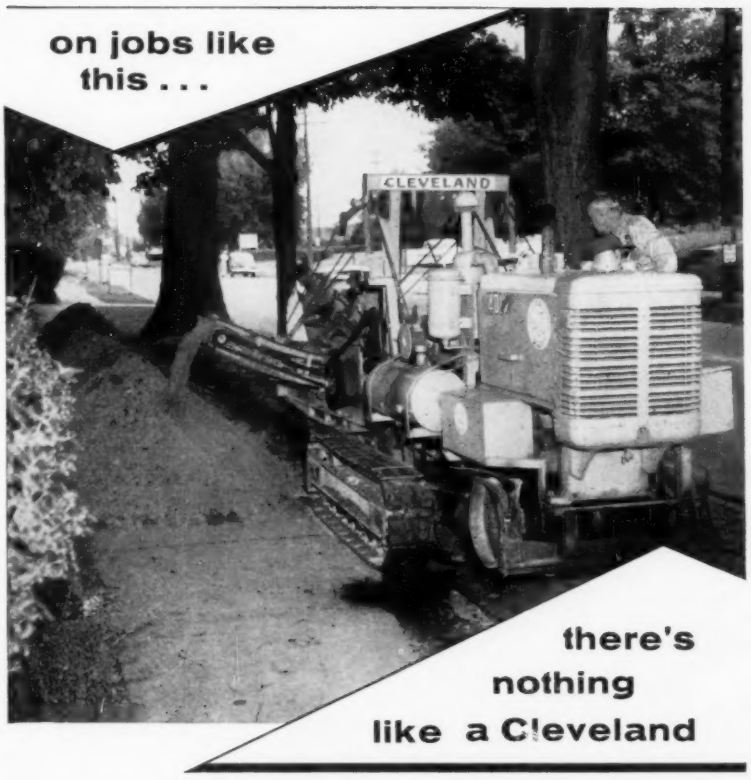
The entire building is air conditioned with gas. Four 5-ton Arkla Servel units are installed behind glass panels, and a 7.5-ton Weatherbuster remote air conditioner is set up on the lawn at the rear of the building.

Utility financing reaching new high

Financing by the nation's privately owned public utilities exceeded $4 billion in the first nine months of 1958. According to a study compiled by Ebasco Services Inc., this is a new high for the period and 5 per cent greater than the total for the corresponding period in 1957.

F. W. Ohles, manager of the company's corporate finance department which prepared the survey, stated that borrowings by utilities slowed somewhat in recent months due to unfavorable conditions in the bond market. During the third quarter, public offerings of about $260 million in debt issues was postponed. Nevertheless, total financings in 1958 are expected to exceed the 1957 record of $4.9 billion.

Financing by gas companies surpassed $1 billion.



TIGHT QUARTERS, narrow tree lawns, digging lines crowded with trees, utility poles, tough roots, intersecting service lines—nothing digs trench like a Cleveland "Baby Digger" in conditions like these.

PRECISION TRENCHING is needed here—a digging job on which a "Baby Digger" has no equal. Note how precisely this Cleveland 92 is placing spoil on sidewalk—off the well-kept lawn. Backfilling will be fast, easy and damage-free. Cleveland's low ground bearing pressure and smooth, friction-free crawlers are also big advantages on jobs like this.

ONLY 4'6" WIDE over its crawlers, the maneuverable 92 digs easily past obstructions, maintains steady, high trench production. More than 30 usable wheel and crawler speed combinations give it the right combination of power and speed for digging all soils—in mud, frost, tree roots, shale or rocky ground.

If city trenching is your job, there's nothing like a "Baby Digger" for you.

The CLEVELAND TRENCHER Co.

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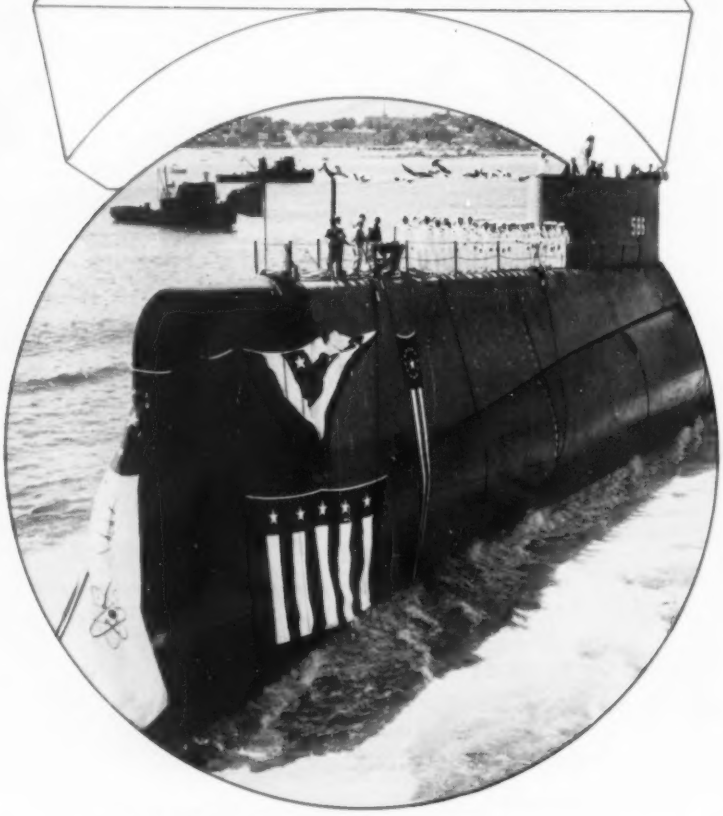
Good Everywhere

BONNEY WELDOLETS
for the world's biggest
ATOMIC SUBMARINE



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Connections ***full size*** *and* ***reducing*** *sizes*
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CARBON STEEL
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for all services

Bonney Weldolets featuring strength, improved flow conditions and easy, economical installation are used on the atomic-powered TRITON, world's largest and most powerful submarine. Launched in August, 1958 at the Groton, Connecticut shipyard of General Dynamic's Electric Boat Division, this twin-reactored sub—447 ft. long and displacing 5,900 tons—is scheduled for radar picket duty.

For detailed information about all Bonney Welding Fittings, call or write today!

BONNEY FORGE AND TOOL WORKS
ALLENTOWN, PENNSYLVANIA

Eastern Quebec towns may get gas supply

It is reported that a gas line may be built from Montreal through Quebec's eastern manufacturing and light industrial belt to Trois Rivieres.

Back of the line are Consumers' Gas Co. and St. Maurice Gas Co. A newly organized company would build the line—estimated to cost between $15 milllion and $30 million, depending on territory served.

St. Maurice has applied for gas franchises in a number of communities, including Granby, Drummondville, Sorel, St. Jean, St. Hyacinthe and Iberville. The company —originallv engaged in gas exploration in the St. Lawrence lowlands of Quebec—also owns outstanding shares of City Gas & Electric Corp., gas plant operator in Trois Rivieres. It also markets propane in that city as well as other Quebec towns.

Unifed gas system sought for part of Kentucky

A unified gas system may be set up to relieve gas shortages in southeastern Kentucky.

In an effort to solve the perennial problem, the Kentucky PSC called on gas suppliers in the area to come up with a satisfactory solution. It was disclosed at commission hearings that a group of gas company officials are considering formation of a syndicate to purchase gas wells and transmission lines of Petroleum Exploration Co., Peoples Gas Co., and Bell-Knox Pipeline Co.

Officials of London Gas Co., Middlesboro Gas Co., Pineville Gas Co., Bell-Knox Pipeline Co., and Associated Drilling Co. make up the syndicate. Area to be served includes the cities of London, Manchester, Corbin, Middlesboro, Pineville, Barbourville, and Burning Springs.

Long Island goes to Texas for gas

Long Island Lighting Co., Mineola, L. I., has a 20-year contract with Valley Gas Transmission, Inc., whereby LILCO will buy up to 32.5 MMcf per day by Jan. 1, 1960. The starting rate, beginning around March 1, 1959, calls for 17.5 MMcf per day.

LILCO President John J. Tuohy said his company is entering into a transportation agreement with Transcontinental Gas Pipe Line

IT TAKES A VALVE WITH "GUTS"

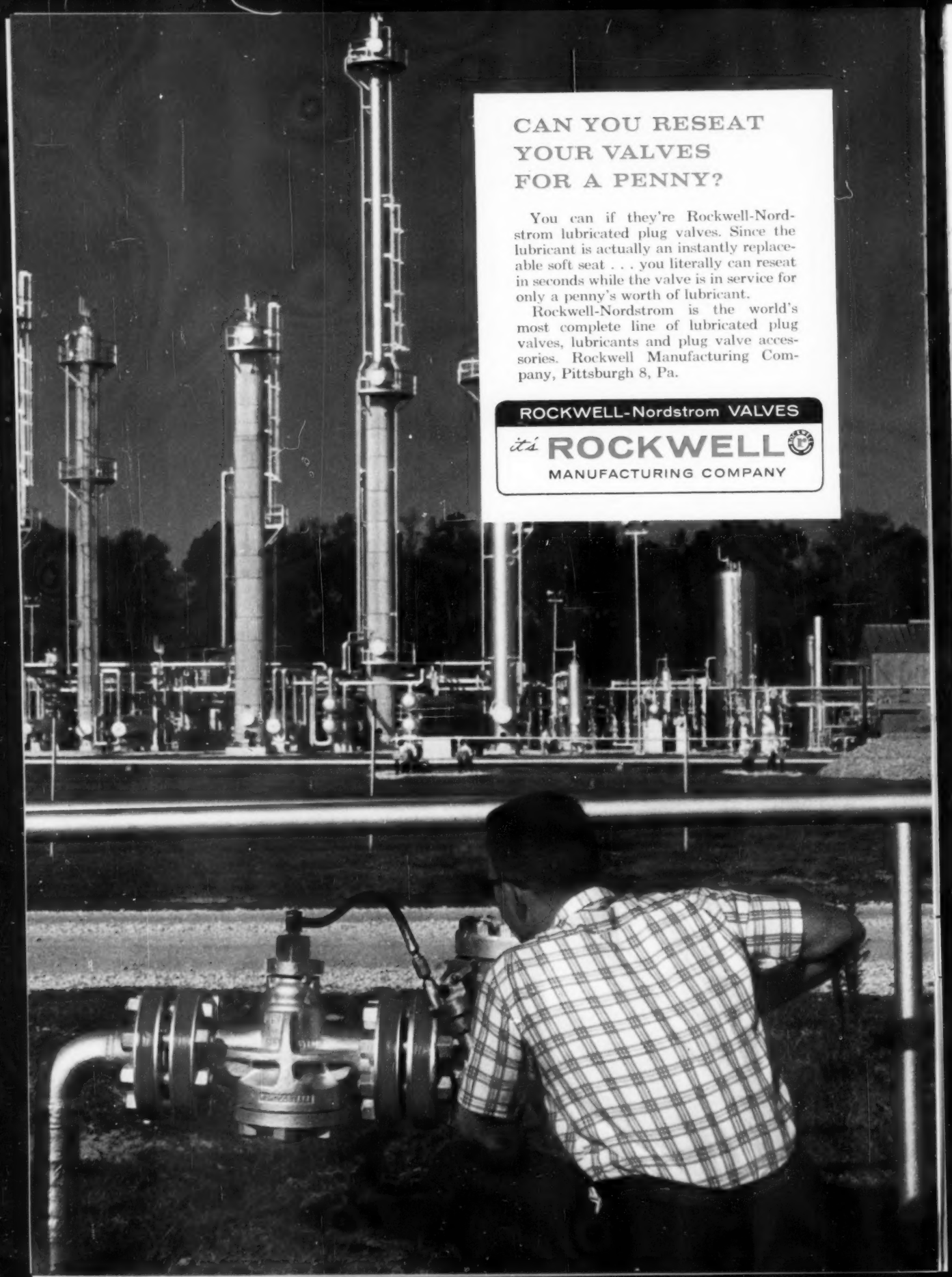
to stay trouble-free and seal tightly on acid and slurry service . . . it takes a Rockwell-Nordstrom lubricated plug valve. Fully protected seats and pressurized lubricant sealing insure positive shut-off, trouble-free operation. Since they cost no more to buy, you pay less for "premium" performance.

Rockwell-Nordstrom is the world's most complete line of lubricated plug valves. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL-Nordstrom VALVES

it's ROCKWELL

MANUFACTURING COMPANY


CAN YOU RESEAT
YOUR VALVES
FOR A PENNY?
You can if they're Rockwell-Nordstrom lubricated plug valves. Since the lubricant is actually an instantly replaceable soft seat . . . you literally can reseat in seconds while the valve is in service for only a penny's worth of lubricant.
Rockwell-Nordstrom is the world's most complete line of lubricated plug valves, lubricants and plug valve accessories. Rockwell Manufacturing Company, Pittsburgh 8, Pa.
ROCKWELL-Nordstrom VALVES
it's ROCKWELL
MANUFACTURING COMPANY

Corp. Transco will transport the gas bought from Valley Gas in Texas to New York. "Such a transportation service," Mr. Tuohy said, "will replace an equivalent amount of gas presently purchased from Transcontinental."

Carolina Pipeline okayed

Carolina Pipeline Co., Columbia, S. C., has a certificate of necessity from the South Carolina PSC for a gas line to serve Abbeville, Calhoun Falls, and Due West. The certificate also covers industrial and commercial users in feasible proximity.

The PSC rejected the application of Piedmont Natural Gas Co. for a similar service. Also canceled was a certificate to Abbeville Natural Gas Co. because the PSC said that both Carolina and Piedmont had offered to serve the area.

Gas reservoir approved

Illinois Power Co.'s proposed underground gas storage reservoir has the go-ahead from the Illinois Commerce Commission. Construction will get under way in Madison county to make gas available to customers in central and southern

A touch of a button controls heating, air conditioning, refrigeration and energy output in the new RCA Whirlpool Miracle Gas Kitchen. The source of all these functions is the Miracle gas center in the kitchen base cabinet. Gas-fueled, the center provides cooling for all the refrigerators and freezers in the kitchen; heats, cools and purifies the air in the entire house. The center is just one of almost innumerable devices used in the kitchen to demonstrate the versatility of gas and the progress of gas appliance research.

Clean walls and smooth floors, without any hand trimming, are signs of a trench dug by the powerful H-5 Hydrohoe-Hydroshovel.

To give you a money-savin' edge...

HERE'S BIG PRODUCTION DIGGING— NEW H-5 HYDROHOE-HYDROSHOVEL-HYDROCRANE

This new H-5 Hydrohoe-Hydroshovel's wrist action generates up to 20,000 pounds of force at even its deepest digging depth — 18 feet. Combine this powerful wrist action with boom crowd-down and digging ram forces and you have OVER 90 TONS of ram force — more than enough to break through tough materials such as coral and frozen ground.

Then, for fast digging, selector valves and the new differential valve put *several speed and force ranges* at your fingertip command. In gas line trenches and mains — or valve and anode pits — you get big production digging.

And the Hydrohoe-Hydroshovel can be converted to crane front end for lifting work. Your Bucyrus-Erie distributor wants to demonstrate *all* the digging advantages of the ½-yd. H-5 Hydrohoe-Hydroshovel . . . and the tricky digging abilities of the smaller ⅜-yd. H-3 Hydrohoe-Hydroshovel. 276H58

BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WIS.

Over 50% of Hydrocranes sold last year were repeat sales.

I'd like complete details on the new H-5 Hydrohoe-Hydroshovel.

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Company _____

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276H58

STOP H_2S CORROSION BEFORE IT STARTS!

The Connelly IRON SPONGE purification process at the well site removes hydrogen sulphide BEFORE the gas is piped to central processing. Thus, the cause of pipe line corrosion is eliminated because corrosive gas never enters the transmission lines. Additionally, Connelly IRON SPONGE eliminates the need for extreme close control. It operates with high efficiency at low or high pressures—absorbs more H_2S, gives longer service between foulings and is easily regenerated. If you have a purification problem check this MOST ECONOMICAL solution today. Write for Field Processing Bulletin #OG-7.

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CHICAGO 8, ILLINOIS

Elizabeth, New Jersey

Efficiency, the key to success in any kitchen, is provided for in Ohio Fuel Gas Co.'s traveling "Better Living Center"—a complete, modern, all-gas kitchen built into a standard-size trailer. The kitchen, designed by OFG's kitchen planning consultant Miss Gaylee Ankerstjerne, features a built-in sectional gas range with table top burners and in-the-wall oven, the new RCA Whirlpool Ice-Magic refrigerator, gas water heater, incinerator, and automatic washer and gas clothes dryer.

Illinois. Between 16,000 and 17,000 new space heating customers will be added.

The company also was authorized to develop and test another gas reservoir near Tilden in Randolph county.

Welding symbols issued

The first major change in welding symbols in recent years has been announced by the American Welding Society. Many additions and improvements are included.

New symbols include those for spot and seam welds made by arc welding; welds used in aircraft, guided missile and automotive work; and for the types of welds used in structural steel fabrication, reinforced concrete work, etc.

Additional information is available from the society at 38 W. 39th St., New York 18.

Test manual published

"Plant Operations Test Manual," a collection of over 80 test methods used in the control of gas processing plants, has been published by the Natural Gasoline Association of America.

Designed for plant laboratory use, the test manual brings together into a single volume tests from many widely scattered sources. Additional information is available from NGAA, 421 Kennedy Bldg., Tulsa 3.

B.C. construction rolling

Construction is under way on B. C. Electric's $500,000 plan to increase reliability of service to the North Shore and north end of Vancouver.

The line, including nearly 100,000 ft of pipe and two river crossings, will provide an alternate route for gas flow into Vancouver.

GAS • News Notes

Missouri's PSC is studying an application by Central Missouri Gas Co. to serve Kirksville and three other northeastern Missouri towns with natural gas. Distribution systems would be set up in Kirksville, Lancaster, Queen City, and Greentop.

Depco Detroit Corp., Detroit, is a new Hydrocrane distributor for Bucyrus-Erie Co., South Milwaukee.

An agreement by General Controls Co., Glendale, Calif., to buy the assets of Foster Engineering Co., Union, N. J., has been announced. General Controls' stockholders must approve the purchase of what may be the nation's oldest automatic valve manufacturer.

Some 2000 people attended the dedication and open house ceremonies when the Kendall Co. opened its new Polyken polyethylene plastic tape plant at Franklin, Ky. recently. Although the plant has been operating since April 1957, dedication ceremonies were delayed until now, according to Manager R. Hanson, because "we started expanding before we completed the initial building program."

Indiana's PSC okayed addition of 4700 heating customers to lines of Indiana Gas & Water Co. Sixteen towns benefited from the order.

A large new plant to meet growing demands for cast iron pressure pipe for gas and water systems was opened at Bensenville, Ill. by James B. Clow & Sons Inc. Built and equipped at a cost of $6.5 million, the new plant produces cast iron pipe of 6- to 16-in. diameter, in 18-ft lengths, by the metal mold process.

Operation Snowflake was launched recently for the fifth consecutive year. This is the U. S. Steel-sponsored program to unite efforts of utilities, manufacturers, retailers, trade associations and financial institutions in promoting major appliances as Christmas gifts.

Long Island Lighting Co.'s automatic dryer sales campaign is under way. The promotion is aimed at more than 500,000 of Long Island's families located in the LILCO territory. About 300 dealers and 14 leading appliance manufacturers are cooperating in the program, which marks the first full-scale promotion campaign by LILCO since it discontinued retail merchandising last July.

"ASTM Standards on Gaseous Fuels" has been published by the American Society of Testing Materials, 1916 Race St., Philadelphia 3. This compilation replaces the 1954 edition. Natural gas, manufactured gas, and liquefied petroleum gases are the materials for which these standards were specifically written. Price of the publication is $3.

American Meter Co. reports that its subsidiary, Buffalo Niagara Industrial Controls Inc., has bought Buffalo (N.Y.) Meter Co., maker of water meters for homes and industry. American Meter's president, W. G. Hamilton Jr., will serve as president of the new subsidiary.

Important changes in fire safety standards are incorporated in a new and revised edition of the National Fire Codes, published by the National Fire Protection Association. Volume I covers flammable liquids and gases. Additional information is available from the NFPA, 60 Batterymarch St., Boston 10.

Low, compact 155 digs 10 FEET DEEP

Small in size, big in capacity, Parsons 155 Trenchliner handles everything from mainline extensions to pipe reclamation and residential service connections. Developed especially for city work, this low, compact trencher cuts 16 to 26 inches wide — *at depths to 10 feet* — digs from 5.8 inches to 25 lineal feet per minute.

Operates in congested areas

The 155 works under low-hanging branches, in narrow alleys, between houses, and in other crowded areas, normally inaccessible to trenchers of comparable capacity. Height is only 7 feet-4 inches — width 5 feet-4 inches. It undercuts walks, curbs, cross-pipes — saves hand clean-up — also makes vertical set-ins, flush with foundations. Hinged crumber swings up, out of the way — positive down-crowd boom starts cut fast, holds accurate grade. Want more facts? See your local Parsons distributor or write to us *today*.

The 155's close side-clearance puts trench within 21 inches of fences, poles, walls. Power-shift spoil conveyor dodges side obstructions. Belt-direction is instantly reversible, places spoil bank on either side of trench. Other Parsons sizes and types range from a small, rubber-tired Trenchmobile to large wheel-type "big-inch" and "middle-inch" Trenchliners.

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P794 GAS

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A DIVISION OF KOEHRING COMPANY

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GREENLEE Hydraulic Pipe Pushers like the one shown below quickly install pipe under streets with a minimum of ditching and backfilling and *no damage to roadbeds or pavement!* A GREENLEE Pipe Pusher cuts job time and costs to a fraction. Can pay for itself on the first job — *usually* does on the first *few* jobs. Model shown pushes 3/4" to 4" pipe about 2 ft per minute with power pump. Larger unit available for larger pipe and concrete sewers. Instead of another useless street repair job, invest the same money in a valuable time-saving, worksaving GREENLEE Pipe Pusher! Write today for free literature.

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GREENLEE

GREENLEE TOOL CO.
1952 Columbia Avenue
Rockford, Illinois

GAS · PEOPLE

W. C. MAINWARING is retiring as vice president of B. E. Electric Co. Ltd., Vancouver, B. C. He has held the post since 1944. He started his career as a meter reader for Nanaimo Gas & Power Co. 47 years ago. Joining B. C. Electric in 1932 as merchandise manager, Mr. Mainwaring advanced rapidly. In 1937 he became general sales manager, in 1944 vice president, in 1945 vice president in charge of Vancouver Island operations, and in 1948 assistant to the president. He is a past president of the Pacific Coast Gas Association.

B. C. Electric also announced the promotion of JOHN J. CARSON to director of industrial relations. For the past two years he has handled employee relations for the company.

New assignments for several key personnel in the accounting department were announced by Southern Union Gas Co., Dallas. FRANK D. JERNIGAN, former director of general and special accounting, has transferred to the enlarged rate and special projects department. EVERITT BAKER has succeeded him as director of general and special accounting. GEORGE S. DAVIS fills Baker's former post of chief accountant.

WILLIAM J. KING has been appointed sales manager of Peoples Gas System's West Coast division in Tampa, Fla. He formerly was sales representative for L. P. G. Equipment Co. in Orlando.

CHESTER L. MAY, who recently retired as senior vice president of Lone Star Gas Co., Dallas, was elected chairman of the board of directors of Arkla Air Conditioning Corp., Shreveport. Arkla also elected ROBERT K. ESKEW a vice president. Mr. May will establish offices in Dallas.

CHARLES A. BOGENRIEF is now director of facilities and tooling for Robertshaw-Fulton Controls Co., Richmond, Va. Since 1942, he has been head of the industrial and plant engineering department of the company's Grayson division in Long Beach, Calif.

W. F. WRIGHT, JR., is now utilization manager for Southern Union Gas Co., Dallas. Wright comes to Southern Union after several years with a large firm of mechanical engineers.

WILLIAM M. LITTLE has joined R. A. Ransome Co., Inc., Washington, as project manager on construction of the North Carolina Natural Gas Corp. system. Mr. Little formerly served as executive vice president of Cascade Natural Gas Co., Seattle, Wash. When construction of the North Carolina system is completed, Mr. Little will become manager of operations for North Carolina Natural.

R. M. MCINTYRE has been appointed to the newly created post of market development manager of Southern Counties Gas Co., Los Angeles. McIntyre, who has been acting sales manager in the company's Orange county division, will be responsible in his new post for the market research and development program of So Counties' sales department. He is replaced in Orange county by DONALD O. BURDICK. W. D. SIMONSEN succeeds Burdick as Santa Barbara division sales manager. In turn, Simonsen is replaced as staff representative, appliance merchandising, by W. J. ALTPETER, who has been new business supervisor in the sales department of the Santa Monica Bay division. TED STERN replaces Altpeter in Santa Monica.

JOSEPH H. LANG is the new manager of Ohio Fuel Gas Co.'s transmission department. He succeeds CLYDE C. PHILLIPS, who retired recently. Mr. Lang, who is as-

William King
Peoples Gas

Chester May
Arkla

William Cottle
Tex-Tube

William Reid
American

Joseph Lang
Ohio Fuel

A. M. Hutchison
Ohio Fuel

sistant vice president of the Columbus, Ohio, company, has served as assistant manager of transmission for seven years. Two other promotions involve transmission department people. ALVIN M. HUTCHISON, superintendent of gas measurement, is now assistant manager of transmission. MICHAEL P. DEBAETS, formerly assistant superintendent, moves up to superintendent of gas measurement.

MAX M. ULRICH has been appointed general manager of advertising and industry research for Consolidated Edison Co. of New York. He formerly was with Edison Electric Institute.

DONALD R. NEFTZGER has been promoted to manager of the Minneapolis district for RCA Whirlpool appliances.

WILLIAM H. COTTLE is the newly appointed head of sales for Tex-Tube, Inc., Houston. He comes to Tex-Tube from Vinson Steel & Aluminum Co., where he served as sales manager.

Two new sales representatives were appointed recently by American Meter Co. WILLIAM A. REID joined the Boston sales territory while MEAD PAYNE is with the Chicago sales territory. Both men recently completed American Meter's six-month sales training course at the Erie, Pa., plant.

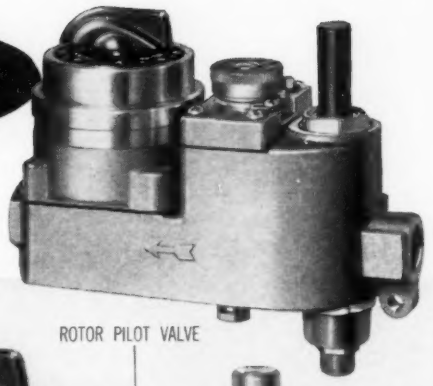
Continued on page 86

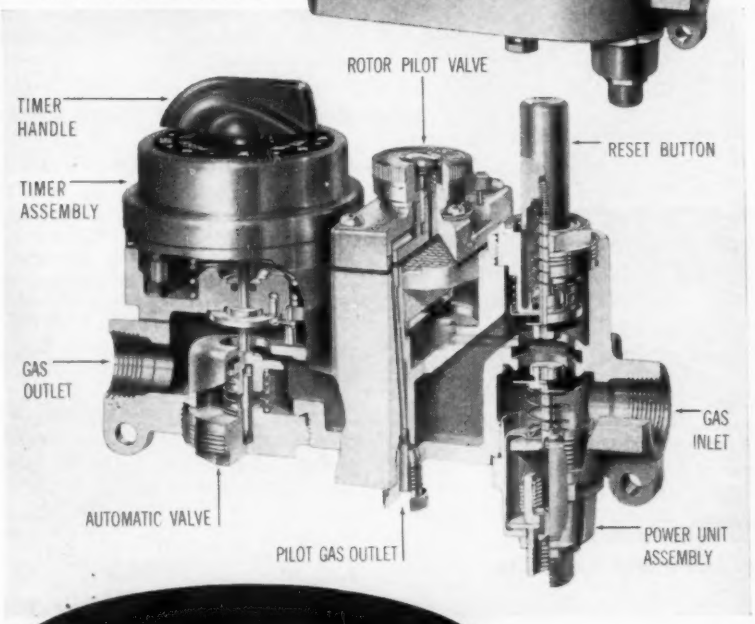
Mead Payne
American

M. P. Debaets
Ohio Fuel

NEW

Designed for **GAS** Incinerators





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Combines 4 units in 1 compact unit

- *Semi-automatic main burner valve* with either 2-hour or 4-hour main burner operation cycle.
- *Baso automatic pilot* for complete shut-off of main burner and pilot burner gas.
- *Rotor pilot valve* with built-in adjustment for "on-off" pilot burner operation.
- *Pilot gas filter* for less pilot outage.

It's easy to install! It's compact and lightweight!

It's the all-new A.G.A. listed Basotrol semi-automatic incinerator valve, designed to give main burner operation in 2-hour or 4-hour periods or for any shorter time. All operating units are replaceable for quick and easy servicing. The main valve timer can be installed in any of four positions at the buyer's option.

Put a Basotrol valve in your new gas incinerator design. Pipe size: ⅜" N.P.T. Capacity: Natural Gas at 1" W.C., 82,880 Btu/hr.

For more information about Basotrol, *WRITE*

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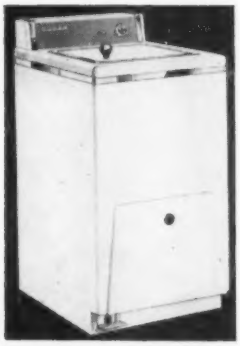
(Formerly Milwaukee Gas Specialty Company)

GAS DIGEST

New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 83, 84



1. Smokeless incinerator

The "custom" and "custom deluxe" Roper smokeless, odorless gas incinerators offer sleek, modern styling and automatic operation. Smoke and odor particles are trapped and re-circulated through Roper's special Turbo-Chamber where they are consumed by intense heat and flame. Only product of combustion is a fine ash, useful as a fertilizer.
Geo. D. Roper Corp.

2. Backhoe

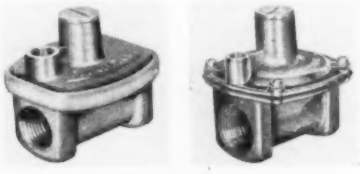
Ottawa's Model LX backhoe, which digs to a depth of 12.5 ft in any position of a continuous 90-deg. arc of swing, and front end loader are now available for the Oliver line of industrial wheel tractors. The backhoe and loader have been engineered as companion tools, and operate from one powerful hydraulic system. However, either attachment can be mounted and operated without the other.
Ottawa Steel Div.

3. Dual-purpose fitting

Dresser's "Stop-N-Go" is a fitting which serves both as a line cap and as an extension fitting for 2-in. gas mains. It is used first as a terminal fitting for 2-in. mains. Later, when main is extended, the end nut and line cap are removed from the end of the fitting. The end nut is replaced and the extension piping is stabbed into the fitting, breaking the diaphragm seal. The end nut is then tightened to the recommended torque, and the joint is complete. The only joining tool required is a wrench.
Dresser Manufacturing Div.

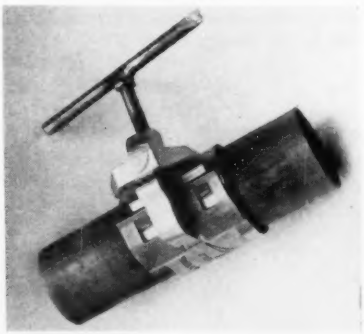
4. Globe valves

Several new design features are incorporated in a line of 600-psi forged steel globe valves introduced by Edward Valves. They are available in .25-, .375-, .50-, .75- and 1-in. sizes with ratings of 600 psi at 910 deg. F in carbon steel and 600 psi at 1030 deg. F in chrome-molybdenum steel.
Rockwell Mfg. Co.



5. Appliance regulators

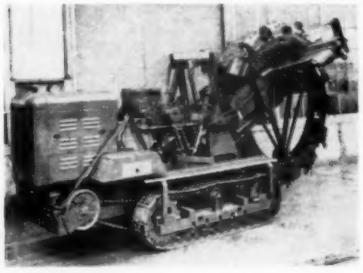
Reduced stack dimensions on two Maxitrol appliance gas regulators permit much wider usage in cramped areas. Model RV-30A is used for main burner and pilot load applications with capacities of 120 to 95,000 Btu per hr, or main burner load applications with capacities from 10,000 to 100,000 Btu per hr. Model RV-41A is used for main burner and pilot load applications with capacities of 120 to 165,000 Btu per hr, or main burner load applications with capacities from 15,200 to 174,000 Btu per hr.
Maxitrol Co.



6. Pipe clamp

The S.O.S. pipe clamp is made in one piece. There are no nuts and

bolts of dissimilar metals to foster corrosion. The entire clamp is made of stainless steel for under or aboveground service. No wrap is necessary in most installations, but if wrap is desired, the clamp can be wrapped easily because there are no protruding bolts.
Harris & Wood Inc.



7. Crawlers

Cleveland's new J-20, J-30, J-40 and JS-30 have new-type V,-shaped discharge conveyors which are driven, shifted and reversed in direction of discharge by an independent hydraulic drive contained within the conveyor. The conveyor is lever-controlled from the operator's seat. Their full crawlers have non-packing, anti-friction-bearing-mounted tracks, dual support, and drive on both ends of crawler pins.
Cleveland Trencher Co.

8. Pilot assemblies

Three new lines of pilot assemblies have been introduced by Eclipse Fuel Engineering Co. Extended pilot burners (Series EP) consist of unusually long pilot burners, gas fired and internally spark-ignited. Gas ignitor assemblies are a compact positive pilot burner assembly, combining spark ignition, pilot and flame sensing rod. Draft compensating pilot supplies gas through a standard injector which carries some primary air for combustion.
Eclipse Fuel Engineering Co.

9. Input-output system

A new auxiliary input-output system is available for the Royal McBee LGP-30 electronic computer. It is available as a combination high-speed punched paper tape reader and punch, or as a reader alone. Model 341 operates on a photoelectric principle and is capable of reading punched paper tape at a rate of 200 characters per second. Model 342 incorporates the high-speed reader and a high-speed motorized paper tape punch in the same unit.
Royal McBee Corp.

10. Diaphragm fabric

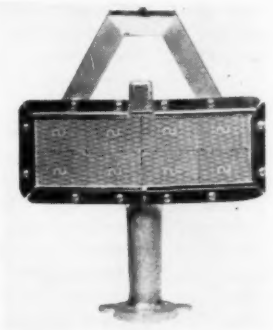
Heat resistant Buna-N/Nylon Reevecote is a heat resistant diaphragm fabric for use in gas appliance regulators and controls. It is specially recommended where controls operate in elevated temperatures for any length of time. The fabric is available in gauges ranging from 0.006 in. to 0.050 in., in several widths from 36 in. up.
Vulcan Rubber Products Div.

11. Vapor vent

OPW-Jordan No. 23 Vapor Vent eliminates hazards of combustible vapors accumulating at ground level. The vent directs escaping vapors upward and allows storage tanks to breathe more freely, increasing the efficiency of tight fill service. Non-corrosive aluminum body with 40 mesh brass screen provides long, durable life. Available in 2-in. size.
Jordan Industrial Sales Div.

12. Locknut

Regent Pipe Squeezer's mechanical locknut assures positive mechanical locking even with temperature fluctuation over extended periods of time. The Pipe Squeezer is a regular tool for cold and hot pipe pinching. Two models are available with the locknut feature: 5024-S, a 40-ton capacity unit designed for use with cold steel pipe up to a 2.5-in. nominal size, and 5045-R, a 15-ton capacity unit designed for use with heated steel pipe up to 2-in. nominal size.
Regent Jack Mfg. Co.

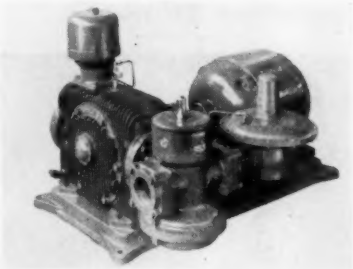


13. Micro-Ray ovens

Hardwick gas ranges with Micro-Ray meat ovens provide housewives with great speed, cleanliness, coolness, economy and convenience. The MicroRay burner operates on a radiant heat principle, generating three micron heat waves. MicroRay is installed in a broiling unit 15.5 in. wide, 19 in. deep, and 17.5 in. high. The meat oven also includes a thermostatically controlled, live-flame rotisserie.
Hardwick Stove Co.

14. Leveling rod

A new three-section Detroit Leveling Rod features easy reading at longer distances and is quick to operate, completely rigid and easily portable. A new steel brace and locking device is used to join the rod's three sections. A latch-type clamp on a steel brace pulls the rod sections together. It can be used in three lengths—4 ft, 8 ft, or 12.5 ft.
Keuffel & Esser Co.



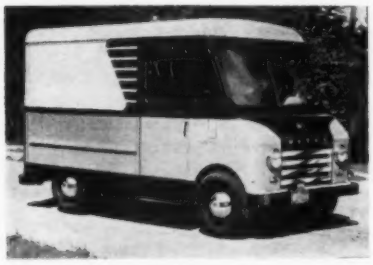
15. Propane diluter

Selas' propane diluter automatically supplies accurate mixtures of LPG and air for standby systems to maintain heat processing operations, space heating, water heating, cooking or refrigeration during

periods of fuel cutoff. The diluter can be connected to existing gas piping and eliminates the expensive need for dual piping, separate air blowers, inspirator mixers, or the like. The design incorporates a balanced pressure, full-floating mixing valve with precision machined gas and air metering ports.
Selas Corp. of America

16. Gas measurement

Concentration of one gas in a multi-component mixture can be measured selectively and continuously with the M-S-A Gas Thermatron. It enables accurate gas analysis without chemical or physical changes of the gas mixture. It provides an improved means of utilizing the thermal conductivity principle of measurement with additional convection cells which take into account differences in convective heat losses from hot filaments through gases.
Mine Safety Appliances Co.



17. Delivery vehicle

International's Metro-Mite is the smallest multi-stop delivery vehicle produced by an American manufacturer. Model AM-80 weighs only 2800 lb, and features unitized all-steel construction. It is rated at 3800 lb gross vehicle weight, and has a payload of 1000 lb. Body capacity is 200 cu ft. Power is supplied by a 51-hp, 4-cylinder engine.
International Harvester Co.

18. Tax computer

Calcu-Tax is a device which shows withholding tax and the new (1959) 2.5 per cent Social Security deductions on one line for wage brackets up to $250. There are no pages to turn, no calculations to perform. Replacements are available as tax rates change.
Calcu-Tax Corp.

19. Filing machine

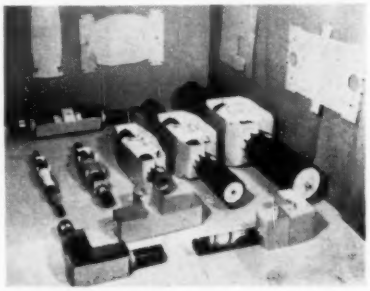
Remington Rand's new Kard-Veyer is designed to simplify and speed office operations requiring reference to large numbers of index cards, records, master punched cards and the like. The filing machine is offered in four standard models which may be modified as to height, width, or both, to suit customer requirements. As many as 75 different sizes and capacities are available.
Remington Rand Div.

20. Range-heater

Fast, clean kitchen heating and convenient, modern cooking are offered in a new Florence kitchen-heater gas range, Model 1-907. A 36,000-Btu burner provides fast-heating action, and a porcelain enamel Dura-Tube finished steel heat exchanger provides high rate of heat transfer. A Modusnap thermostat provides even room temperature automatically.
Geo. D. Roper Corp.

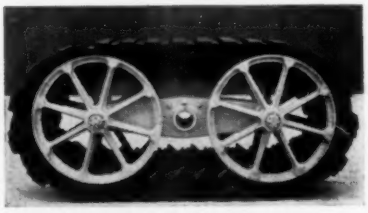
21. Gas furnaces

"Dixie Aire" sectional gas furnaces have extra large blower capacity, for use in conjunction with summer air conditioning. Three capacities, all AGA approved, are available: 60,000 Btu, 2100 cfm; 85,000 Btu, 1600 cfm; and 115,000 Btu, 2000 cfm. Steel heat exchanger sections of airfoil design are located on 4.5-in. centers with 2.5-in. minimum clearance between sections to insure ample air flow and efficient operation.
Peerless Corp.



22. Joint molds

The use of P.C. joint molds allows coating of joints and cutbacks with the same material and manner of application as mill-coated pipe, including the bottoms of joints, for complete protection from corrosion. One experienced man can assemble the molds and complete the operation without danger of hot-coating burns. They are available for standard pipe diameters up to 6-in.
Dearborn Chemical Co.



23. Trac-Wheels

Simplified track design used in M. J. Crose's new "Trac-Wheels" is said to reduce costs, offer greater track bridge strength and wear resistance, and feature one-point lubrication system. Trac-Wheels have been used on pipe coating kettles and pipe bending machines.
M. J. Crose Co.

TRADE LITERATURE

24. Valve-regulators

Complete installation, operation and maintenance instructions for Rockwell - Nordstrom valve-regulators are described in a 16-page publication from Rockwell's Meter and Valve division. The photo-

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illustrated maintenance manual also includes special sections devoted to operational troubles, how to check troubles, orifice and nozzle cleaning, how the positioner and controller works, adjustments, etc.
Rockwell Manufacturing Co.

25. Centrifugal compressors

Clark Bros.' single-stage centrifugal compressors and exhausters are covered in a new bulletin. The units, rated at 1200 to 80,000 cfm and 10 to 2500 bhp, are for gas and air service.
Clark Bros. Co.

26. Gas chromatograph

Beckman/Scientific and Process Instruments division has published Bulletin GC-4117, "Industrial Gas Chromatograph Model 220 Controller." The multi-stream, multi-component controller for chromatographic analyses is described and instrument specifications are listed, together with mounting dimensions.
Beckman/Scientific

27. Flowrator meter

Variable-area armored flowrator meter for high temperature applications, both gas and liquid service, is described in Specification Bulletin 10A1152 from Fischer & Porter. Given are operational limits for standard 150- and 300-lb designs, capacity tables, and other technical data.
Fischer & Porter Co.

28. Inert gas generators

Two new bulletins on inert gas generators are available from C. M. Kemp. Bulletin I-106 gives technical and descriptive information on 500 and 1000 cfh panel enclosed inert gas producers. Bulletin I-107 gives data on a new line of purge producers, designed for use where inerts are needed for blanketing, purging and protective purposes.
C. M. Kemp Mfg. Co.

29. Manometers

A 24-page catalog from King Engineering discusses manometers for measuring pressure and vacuum in plants and labs. Included are sections on U-type, well-type (single- and multi-tube) and inclined-tube manometers, manometer indicating liquids, and accessory equipment.
King Engineering Corp.

30. Engine test

The DuMont EnginScope and IgnitionScope, their operation and proved performance as test equipment, are described in two new brochures. Photos show the tv-type automatic test equipment in use.
Allen B. DuMont Laboratories

31. Welding supplies

A 52-page catalog of welding supplies and accessories has been published by Air Reduction. Illustrated with more than 100 photos, the booklet covers Airco's complete line.
Air Reduction Pacific Co.

32. Heat exchangers

Southwestern Engineering has issued a new comprehensive catalog covering its complete line of heat exchangers and pressure vessels, designed, engineered and manufactured for the process and power industries.
Southwestern Engineering

33. Cooling tower

Literature is available on Arkla Air Conditioning Corp.'s new cooling tower, which incorporates the latest developments in cooler design. Included are specifications and dimensions for the evaporative cooler for use with the Sun Valley all-year gas air conditioner.
Arkla Air Conditioning Corp.

34. Plastics

Dozens of rigorous quality control tests which ensure that Tenite plastics will meet customer requirements are described in a new 20-page book from Eastman Chemical Products. "Quality Control — A Company's Conscience at Work," includes numerous photos, in full color and black and white, to give readers an intimate understanding of the operations of Eastman's quality control labs.
Eastman Chemical Products

35. Thermocouple wells

Bulletin 2000 gives details of a new line of Serv-Rite drilled thermocouple wells, thermometer sockets, and thermometer wells. Eighteen different styles of wells for pressure installations are discussed.
Claud S. Gordon Co.

36. Leak detector

Leak-Tec division of American Gas & Chemicals has published a folder on its leak detecting solution. Solutions are available for a variety of leak detecting applications, including gas lines.
American Gas & Chemicals Inc.

37. Thermocouples

Complete description and specifications of Bristol's recently announced Armorox thermocouples are given in Bulletin P1281. Available types, materials, sizes and thermocouple curves are detailed. Applications for which Armorox thermocouples are especially recommended are suggested.
Bristol Co.

38. Single-stage compressor

Just published is Bulletin 165 which describes Clark single stage centrifugal compressors. Two types are presented: Series OPB for gas applications plus high pressure air and Series OM for low pressure air service. Complete details are given on casings, bearings, seals, impellers, lubrication system, baseplates and couples, plus recommended applications.
Clark Bros. Co.

39. Gas incinerator

Catalog information is available on a new household gas incinerator from Joseph Goder Incinerators.
Joseph Goder Incinerators

40. Process control

A newly improved process control instrument for continuous measurement of the concentration of one gas in multi-component mixtures is covered in Bulletin 0716-2 from Mine Safety Appliances. Applications to a variety of gas analysis problems are suggested.
Mine Safety Appliances Co.

41. Diaphragm temperatures

Advantages of diaphragm temperature sensors for use in home and commercial appliances is discussed in a bulletin from Bridgeport Thermostat division.
Bridgeport Thermostat Div.

people • *Continued*

from page 79

MARTIN J. SHERRY has been appointed account executive in the Industrial Controls division of General Controls Co., Glendale, Calif.

JOHN F. SISSON has joined the legal staff of Columbia Gas System Service Corp. in New York. He has been a member of Ohio Fuel Gas Co.'s legal staff since 1953. Mr. Sisson's appointment came at the same time as the retirement of JACOB R. HARVIN, vice president and director of the Columbia Gas System, and vice president and counsel of Columbia's Service Corp. Harvin is succeeded as vice president and counsel of the service organization by RICHARD A. ROSAN, who was serving as assistant counsel.

Martin Sherry
Gen. Controls

Jack Fatherree
Lone Star

Gerard Boeve
Peoples Gas

Howard Taylor
Equitable

JACK FATHERREE, accountant for Lone Star Gas Co.'s Fort Worth division of distribution, has been promoted to assistant treasurer of the division. He replaces CLARK K. FLETCHER, who has retired.

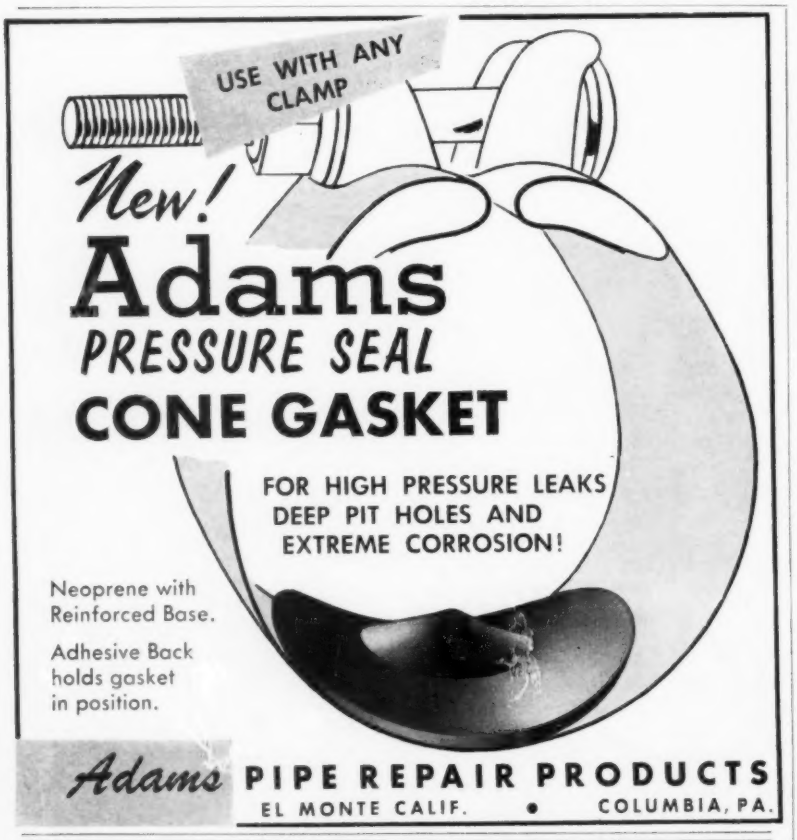
GERARD C. BOEVE has been promoted to sales manager of the East Coast division of Peoples Gas System, North Miami, Fla. He has been commercial and industrial sales supervisor for the division.

HOWARD W. TAYLOR has been named manager of accident prevention for Equitable Gas Co., Pittsburgh. He will be responsible for the planning and coordination of the company's accident prevention, safety, first aid, workmen's compensation and employee suggestion programs.

CLAYTON E. BAIRD has been promoted to sales manager and O. H. NIBBELINK is now Waukegan district manager for North Shore Gas Co., Waukegan, Ill. Baird, a 33-year veteran with the company, most recently served as north division manager. Nibbelink, with the company for 28 years, has been manager of appliance sales.

CHARLES W. BRYDON is controller of Neptune Meter Co., New York. He joined Neptune in 1952 as assistant treasurer.

NORMAN F. GARRETT is the newly elected vice president and general manager for manufacturing of Crane Co., Chicago. He will direct operations of plants in Chicago, Chattanooga, Trenton, N. J., and Colton, Calif. Newly appointed assistant general manager of the Chicago division is WALTER KOVALICK.



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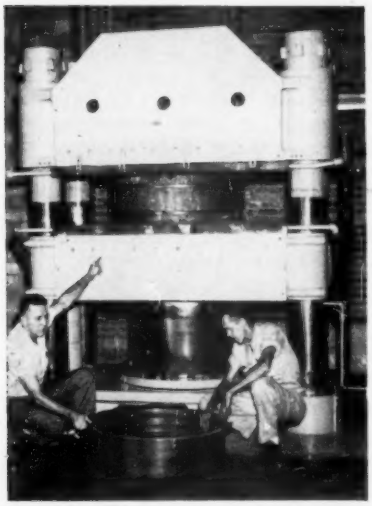
A. Otis Smith
Wash. Nat.

Louis McGowan
Rockwell

Washington Natural Gas Co., Seattle, has set up a new division in its sales department to meet the growing need of realtors for gas service information. Heading the new operation as supervisor of realtor relations is A. OTIS SMITH. He joined the company in 1955 as a sales assistant and in 1957 was promoted to new construction sales representative.

DONALD L. BENSCOTER is Dallas district manager for the Burroughs Corp.'s ElectroData division.

LOUIS A. MCGOWAN, chief engineer of Rockwell Manufacturing Co.'s DuBois, Pa., gas meter plant, has been named assistant chief engineer for the company's Barberton division. Mr. McGowan joined Rockwell in 1947 as a project engineer at Pittsburgh.



Bill Seales (left), plant engineer, and Bud Sisson of the maintenance department, inspect a part made during the trial run of the new 1200-ton, 50x66-in. hydraulic rubber press just installed as the first step in F. H. Maloney Co.'s new expansion program. The press is now in production molding pipeline crossing casing end seals, mud seals, etc.

A MANUAL ON THE USE OF

Plastic Pipe and Fittings

in the Natural Gas Industry

This manual provides a wealth of background information invaluable to gas distribution men responsible for plastics pipe applications.

It traces the development and progress of plastics piping in the gas industry, details the properties and performance of these piping materials in gas systems, and describes both routine and unique applications gas companies are making of plastics.

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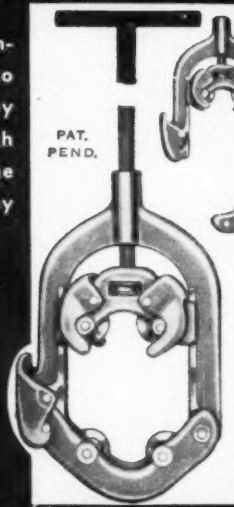
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



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Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

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LOOSENS
rusted bolts, nuts, screws, 'frozen' parts

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- NATION'S MOST WIDELY USED LOCATOR!
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ORDER NOW — Wire or call Kirby 1-4200 collect for fastest delivery!

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RICHARD C. ROSE is the newly appointed superintendent of motor transport for Ohio Fuel Gas Co., Columbus. The former assistant superintendent will be in charge of purchasing, operation and maintenance of Ohio Fuel's fleet of more than 1900 company cars, trucks, trailers and motorized equipment.

GEORGE C. WILLIAMS has been named director and general counsel of East Ohio Gas Co., Cleveland, a newly created post. Formerly of New York, Williams was associated there with Consolidated Natural Gas Co., East Ohio parent.

Southern Union Gas Co., Dallas, has made managerial changes in two of its largest operating districts, El Paso and Albuquerque. E. C. REDDY, formerly Albuquerque district manager, is now manager of the company's El Paso district. C. A. STOCKHOFF, who has been Albuquerque district sales manager, succeeds him as district manager in that district. Reddy will be in charge of all phases of Southern Union's operations in both El Paso and Alamogordo, N. M. Stockhoff will be responsible for company operations in Albuquerque, Belen, Bernalillo, and Los Lunas, N. M.

LE ROY O. MACLEOD has retired as advertising manager of New York State Electric & Gas Corp., Binghamton, N. Y. With his retirement, HOWARD A. PRAEGER, manager of sales promotion, becomes manager of sales promotion and advertising. LESLIE E. BAILEY, a member of the staff, has been promoted to supervisor of advertising activities. Other promotions in the advertising department include: PAUL D. BLISS from artist to art director; ROBERT H. CORNALL from chief display designer to manager of the display shop, and JOHN H. KING from display designer to chief display designer.

JAMES T. LANGHAM has been appointed sales representative for Blaw-Knox Co.'s Buflovak Equipment Division, Buffalo, N. Y. Mr. Langham, with headquarters in Dallas, covers Oklahoma, Louisiana, and Texas.

DON E. MOORE has been named regional sales manager of the Auburn (Neb.) Machine Works. For-

merly he was sales and advertising manager of Earth Equipment Corp., Los Angeles. In his new post, Moore will be in charge of sales for the 11 western states.

F. H. Maloney Co., Houston, has opened a Chicago office. In charge of the operation is BOB CHURNSIDE. Recent addition to the Houston staff as a sales engineer is JOSEPH V. KIDD.

Headquarters for sales management of Black, Sivalls & Bryson's oilfield equipment division have been established in Houston. FLOYD C. MYERS, vice president and manage of oilfield sales and service, has transferred to that city.

GLEN TABLEMAN has been appointed manager of W-K-M Valve Co. (Britain) Ltd. Mr. Tableman previously was general sales manager of W-K-M in Missouri City, Texas.

Ebasco Services, Inc., New York, has appointed H. K. FAIRBANKS as consulting civil engineer, H. W. STUBER as chief concrete-hydraulic design engineer, and A. T. LARNED as associate consultant in the consulting engineering division.

ROBERT H. QUAYLE, JR., is the newly appointed executive vice president of the Norge Home Appliance division of Borg-Warner Corp., Chicago. Most recently, Quayle served as division merchandise manager of Montgomery Ward & Co.

LEWIS C. BLACK is now manager of domestic sales for Bucyrus-Erie Co., South Milwaukee. He has been manager of sales for large excavators since January of this year. Bucyrus-Erie also appointed PHIL PETERSON as a district sales representative for Hydrocranes, Hydrohoes and Hydroshovels. From his headquarters in New York, Peterson will cover Pennsylvania, Virginia, West Virginia and Maryland in addition to lower New Jersey and the District of Columbia.

CAROLYN J. KRAUSE has been promoted to Fremont district home service director for Ohio Fuel Gas Co., Columbus. For the past year, Miss Krause has been home service adviser in Tiffin.

THOMAS W. CONNETTE will retire next month as vice president and western division manager of New York State Electric & Gas Corp., Ithaca. He will be succeeded by CHARLES E. BALTZEL, Plattsburgh district manager of the company. FRANCIS X. BROWNE, Lancaster district manager, will replace Baltzel at Plattsburgh.

Deaths

DR. MARVIN O. SHRADER, 45, supervisor-organic chemicals research of Pittsburgh Coke & Chemical Co.'s research and development department, died recently. Dr. Shrader had been awarded numerous U. S. and foreign patents in the field of industrial chemistry. He had been with Pittsburgh Coke since 1952.

FRANK T. O'DELL, creator of the Mueller hot water heat control system and an employee of Mueller Co. for more than 35 years, passed away recently in Naperville, Ill. Mr. O'Dell joined the Decatur, Ill., company as a sales representative in the Minnesota territory. It was during the early 1920's that he developed his famous heat control system. Mr. O'Dell retired in 1954 at the age of 76.

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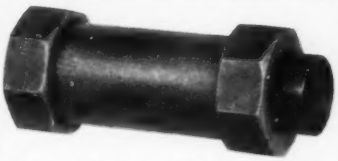
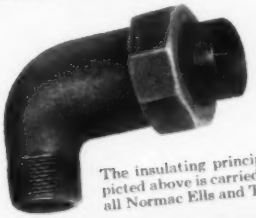
Malleable Couplings



Normac Insulating Malleable Couplings and fittings are available with polyethylene inserts and semi-insulating gaskets or full insulating rubber gaskets.

Insulating Couplings AND Fittings

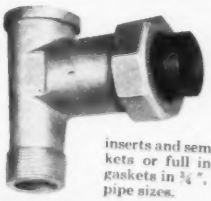
Malleable Service Ell



The insulating principle depicted above is carried out in all Normac Ells and Tees.

NORTON McMURRAY has specialized for 20 years in the development and production of products solely for the Gas Industry. Whether your plans include modernization, or new, expanded facilities, Normac Gas Distribution Equipment will serve you well.

Brass Fittings



Normac insulating Brass compression end Tees, Ells and all compression end fittings are available with polyethylene inserts and semi-insulating gaskets or full insulating rubber gaskets in ¾", 1" and 1¼" iron pipe sizes.

Insulating Gaskets

The Normac insulating principle incorporates an efficient combination of a polyethylene sleeve and a semi-insulating gasket or full rubber gasket and retainer ring.

New CATALOG

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Exclusive Features

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Plus Packaged Promotions For Dealers

Make big profits running tested promotions that fit your business to a "T." Siegler supplies a complete package of material for each promotion and helps you run it.

SIEGLER HEATER COMPANY, CENTRALIA, ILL.

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THE HIGH PROFIT LINE

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GULF GULFTANE LP-GAS BUTANE PROPANE

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Let SCF consultants "Ride Herd" on your gas leaks—account for "unaccounted-for" and eliminate safety hazards.

We can supply "Extra hands" and equipment to repair leaks if you need the help.

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Washington • *Cont'd.*

from page 16

The Memphis case, or at least the cases that it will create, will be in the courts for years, one gas industry legal expert says.

This source points to the high court's penchant in recent years to legislate and to break its own regulatory trails, rather than to rule strictly on the legal, constitutional, or procedural questions which come before it. And they point, too, to the morasses it has made in dozens of such sweeping rulings.

Another possibility is that the court may use the Memphis case to answer some of the questions left unanswered in the somewhat similar Mobile case. In the Mobile case, the contract at issue was for a flat period at a fixed rate, whereas in the Memphis case, the contract at issue contained a reservation for "effective superseding rates."

During the hearing before the Supreme Court on the Memphis case, U. S. Solicitor General J. Lee Rankin tipped the FPC's hand on control of gas producers.

Rankin, arguing for the FPC, commented at the end of this statement, and apparently gratuitously, that when some 11,000 suspended producer rate cases are disposed of (by 1961), the commission will put producers under a tariff-service agreement structure so that they can regulate themselves "in the same manner as pipelines."

This unusual remark completely surprised top FPC officials, who had spent days talking with Rankin on the whole range of gas industry problems before the hearing, but said they hadn't figured he would use any more than was germane, particularly to the Memphis case.

Rankin, didn't give any details of this tariff-service agreement plan, and FPC officials quickly clammed up.

The oral argument before the Court on the Memphis case followed pretty closely the original written arguments submitted earlier.

FPC and the pipelines argued they would suffer tremendous injury if the short-cut section 4 rate

increase is closed except when all customers give advance consent. This, they said, would force them to use longer procedures, which might take four or five years to produce higher rates to cover higher costs of gas, labor, taxes, and whatnot.

Rankin disputed contentions of the city of Memphis that the original Mobile case decided by the high court covered the Memphis case. Rankin got the support of Justice John Marshall Harlan, who wrote the Mobile decision, in his argument that the two cases covered different situations.

Rankin contended that the consumer and the country as a whole have a heavy stake in the outcome. Without the flexibility in rates which section 4 gives, pipelines will be unable to expand or to attract capital, and thus service will be hurt, he contended.

Attorneys for the City of Memphis argued also that many industrial users purchase gas under conditions which exempted them from rebates if the FPC in a section 4 proceeding finds rate proposed by a pipeline to be too high.

When the final Supreme Court decision on the Memphis case is known, there's a good chance that either one side or the other will try for legislation to win the controversy.

This, political insiders say, could erupt into a battle at least as bitter as that which has followed efforts to get legislation to upset the 1954 Court ruling in the Phillips case.

It could, they say, turn the industry upside down, block any attempts at real unity, and in the end bring death to any new gas legislation in the fields either of regulation of independent producers or pipeline rate increases procedures. ■

Regulatory Trends

Continued from page 11

The Court added that the outspoken attitude of the company that it reverted to the straight line method because it could not retain the benefits of accelerated depreciation is unbecoming. The Court concluded: "We do not believe, however, that it would be proper to require, as a matter of law, this utility or any other utility to use a particular method of depreciation in computing the federal income tax allowance when the law permits the use of any of several methods which ultimately allows only the deduction of depreciation over the life of the property. The conclusion of the commission that there has been no abuse of managerial discretion in this instance will not be disturbed."

The utility in a prior rate case had paid income taxes on an accelerated depreciation basis and the Commission flowed the tax reduction through to the ratepayers with the Court's later approval. Then the utility elected to return to the normal straight-line depreciation method for computing income taxes. In each case the Commission allowed the actual taxes paid by the utility and gave it freedom of choice in the optional methods under the Revenue Code.

Normalized taxes are ahead

A majority of regulatory commissions recognize the deferred

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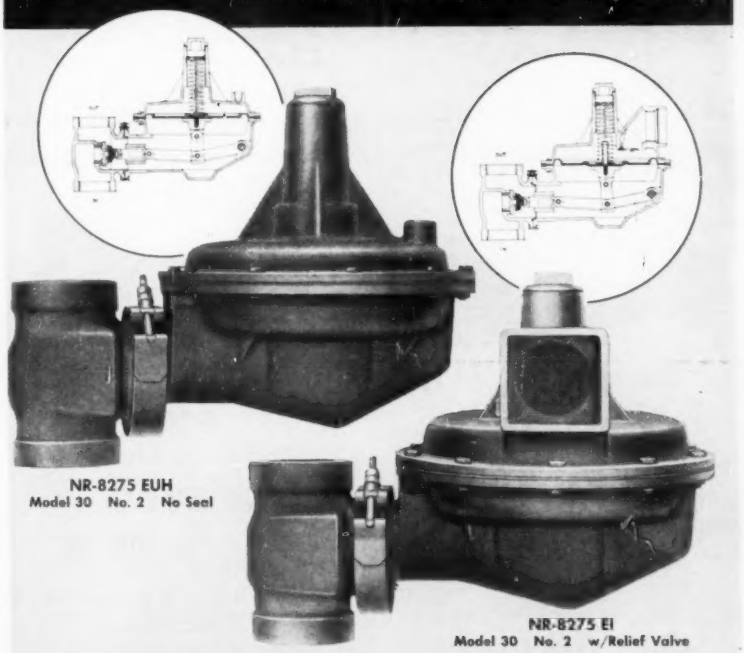

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VARIATIONS IN CONSTRUCTION COVER ALL REQUIREMENTS

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Peerless GAS UNIT HEATERS

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- SELF CONTAINED
- AUTOMATICALLY CONTROLLED
- INTEGRAL MEANS OF AIR CIRCULATION—EITHER FAN OR BLOWER
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- AND MANY, MANY MORE REFINED DETAILS THAT ARE PEERLESS EXCLUSIVES

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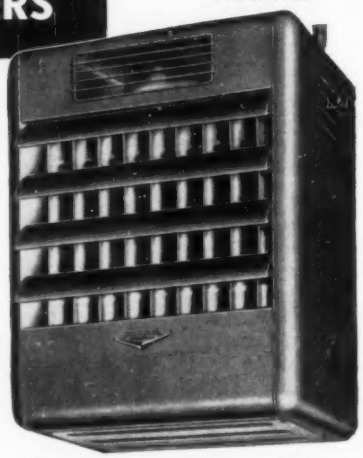
The MOST ADVANCED HEATER ON TODAY'S MARKET



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P.T.O.-driven King Winch on Willys Jeep FOR ALL WILLYS JEEPS, 4 WD TRUCKS AND 4 WD STATION WAGONS.

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King Winches for International trucks available through International dealers.

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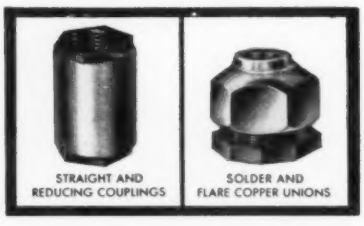

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taxes when a utility takes accelerated depreciation, and they normalize taxes for rate-making. Sixteen state commissions and two Federal Power Commission Trial Examiners have adopted normalized taxes for prescribing customer rates. Only eight state commissions have disallowed normalization. To add to the weight of authority favoring the recognition of deferred taxes for both accounting and rate-making, the American Institute of Certified Public Accountants recently issued its Bulletin No. 44 Revised.

Most experts have the opinion that the disclosure of tax deferrals must be made in financial statements even though accelerated tax depreciation results are permitted to flow through to the ratepayer. They maintain that the postponed tax liability inherent in the flow-through method will be known to informed investors. Appraisals of utilities for investment will lead to the conclusion that one with normalized taxes will be more attractive than one using the temporary tax reductions, under rapid depreciation, to decrease rates.

The conservative advisers claim that it would be an act of good business judgment to elect straight-line or normal tax depreciation rather than to accept the flow-through treatment. Under the flow-through method there is a resulting risk of loss through a utility's inability to recover in future years, by increased customer rates, the revenue lost in earlier years through price reductions. The one constant caution before management is that a utility is not guaranteed a fair return, but only the opportunity to earn it. Economic conditions, and the price of competitive services, such as oil, coal and electricity, may make it impossible for a gas company to increase its prices in the future when deferred income taxes become payable. ■

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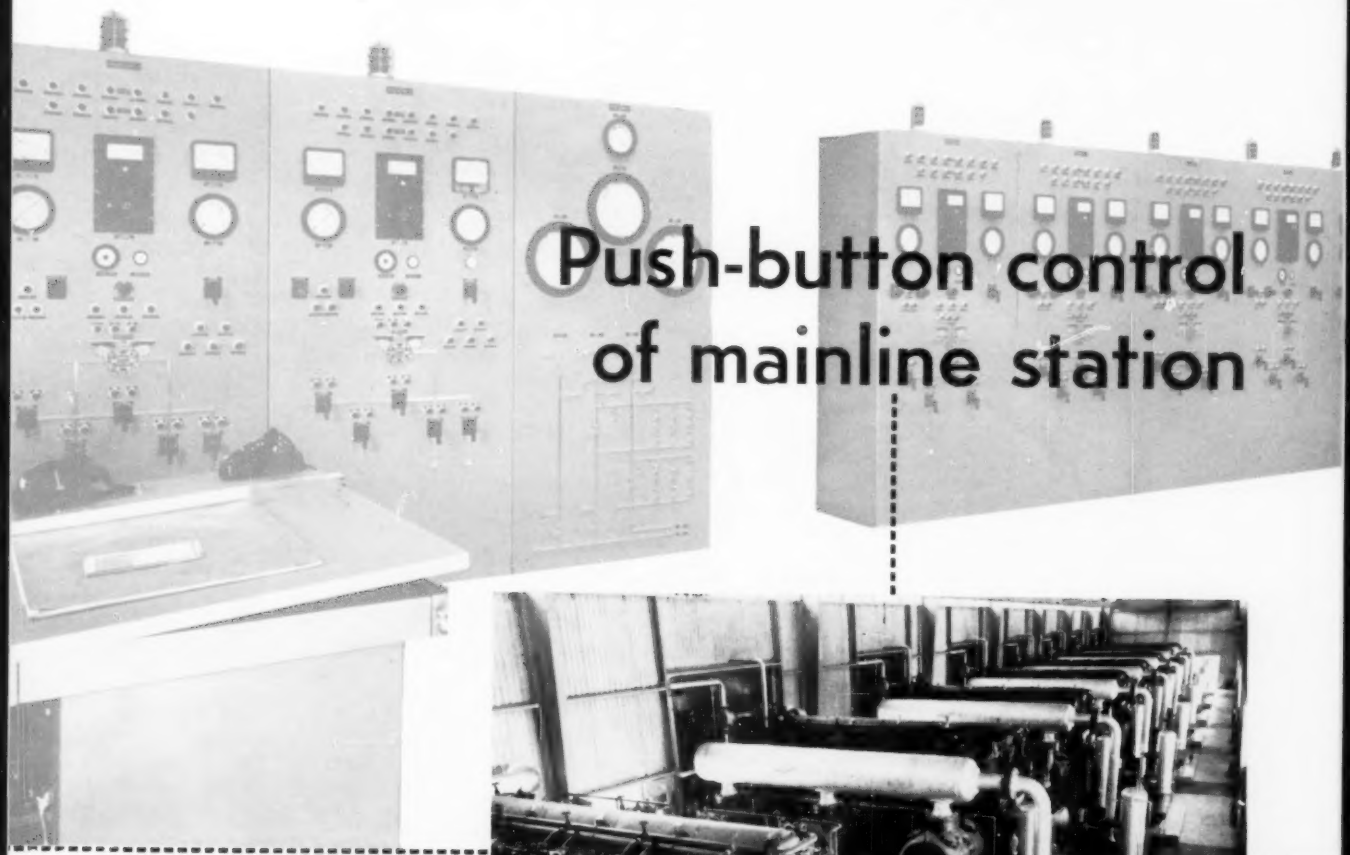
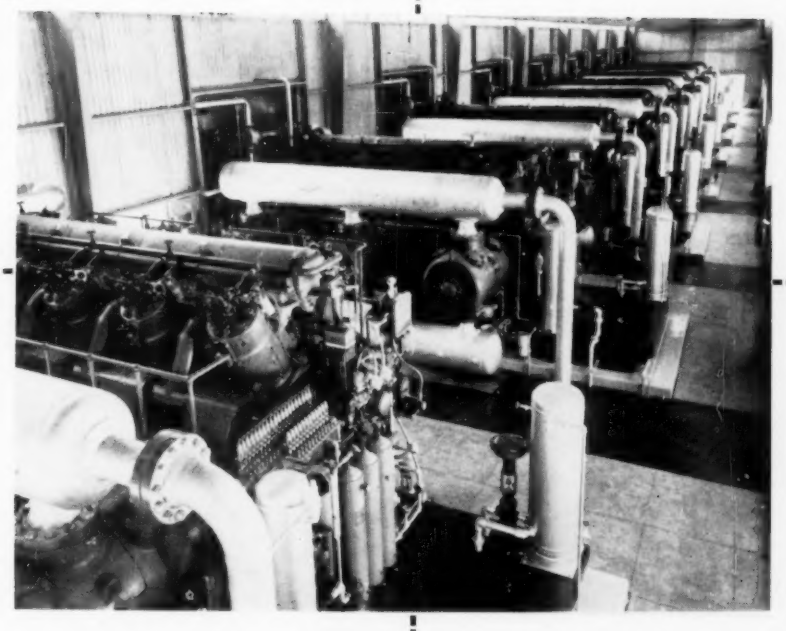
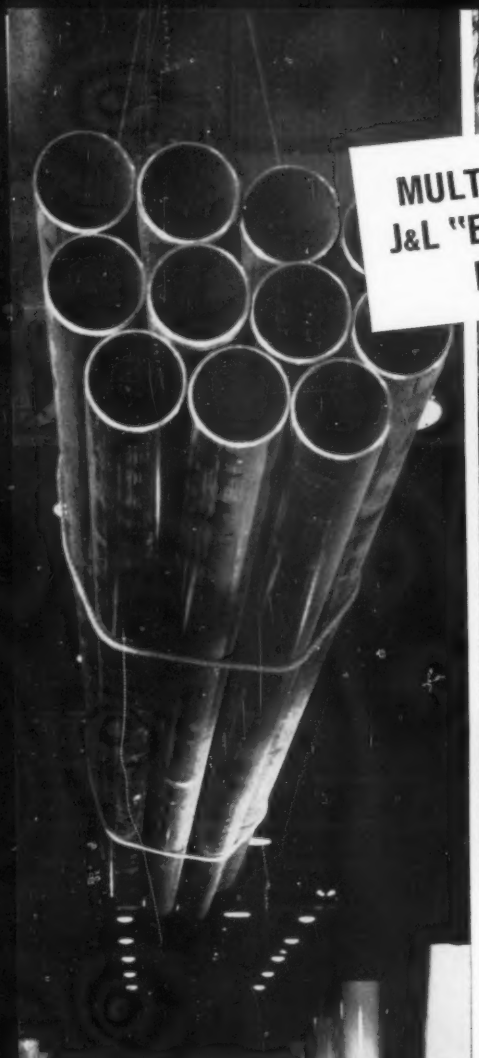
GAS

PIPELINE SECTION



Push-button control of mainline station





MULTIPLE-TESTED J&L "ELECTRICWELD" LINE PIPE

J&L's 12¾-inch Electricweld line pipe was used in 22 miles of this Cherokee Pipe Line Company line.

"J&L Electricweld pipe bends readily to contours, is easy to weld"

. . . reports Pipe Line Service Company

Twenty-two miles of J&L's 12¾-inch O.D. Electricweld line pipe were installed by the Pipe Line Service Co., Seminole, Okla., in this line for the Cherokee Pipe Line Co.

"Our pipe must be uniformly round, bend readily to correct contour, and weld easily," says this pipeline contractor. "J&L pipe meets our specifications. It enabled us to avoid delays on this job over hilly terrain."

Electricweld line pipe is produced by Jones & Laughlin, an integrated steel company, under most rigid quality controls. Weld area of the steel is blasted with steel grit under 100 psi in a "Vacu-Blast" unit to clean the surface for perfect contact with the welding electrode.

During the electric resistance-welding process, electronic controls maintain exact welding heat at all speeds. After welding and trimming, pipe passes through an induction annealing unit to assure uniform grain structure in the weld area.

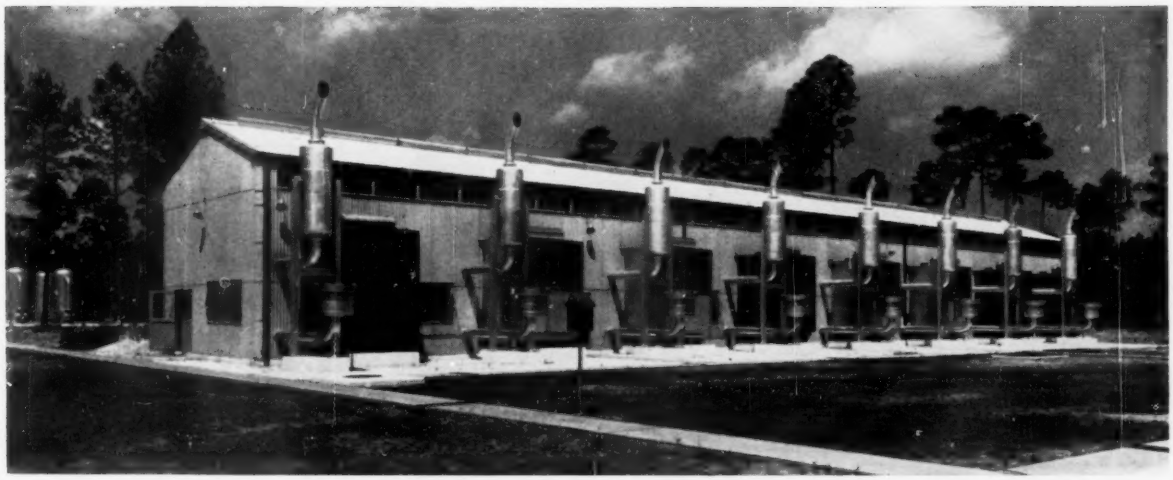
Every length of pipe is thoroughly checked through visual examinations, hydrostatic tests, flattening tests and magnaflux inspections. All Electricweld pipe is manufactured and tested in strict compliance with appropriate A.P.I. and A.S.T.M. specifications.

Electricweld pipe is available from 6⅝ inches through 12¾ inches and in lengths to 60 feet. Get the facts on this superior quality line pipe from your distributor, or write to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

J&L STEEL

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA



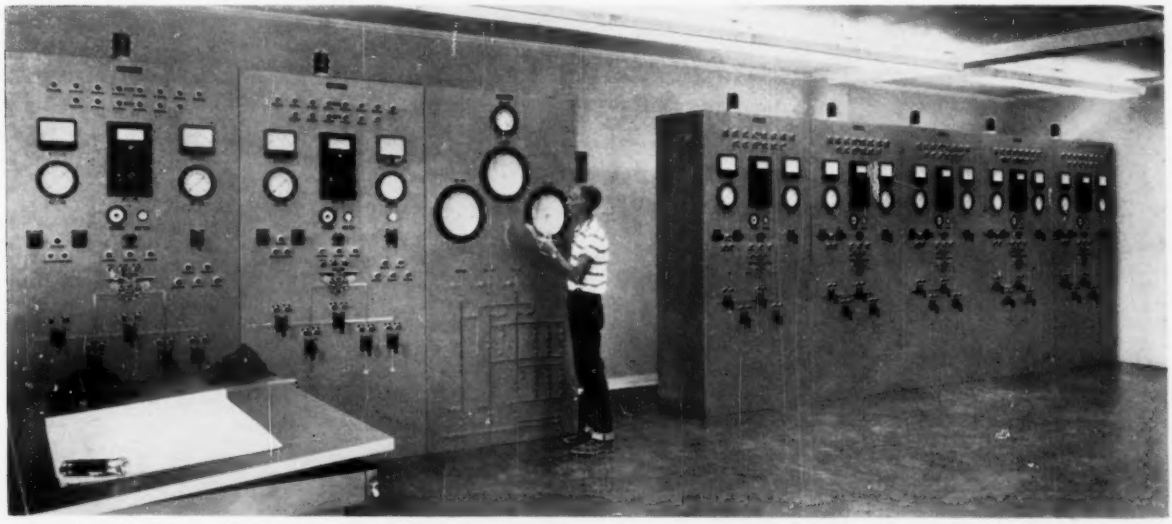
Exterior view of Southern Natural's Franklinton compressor station.

Single push-button system controls mainline station

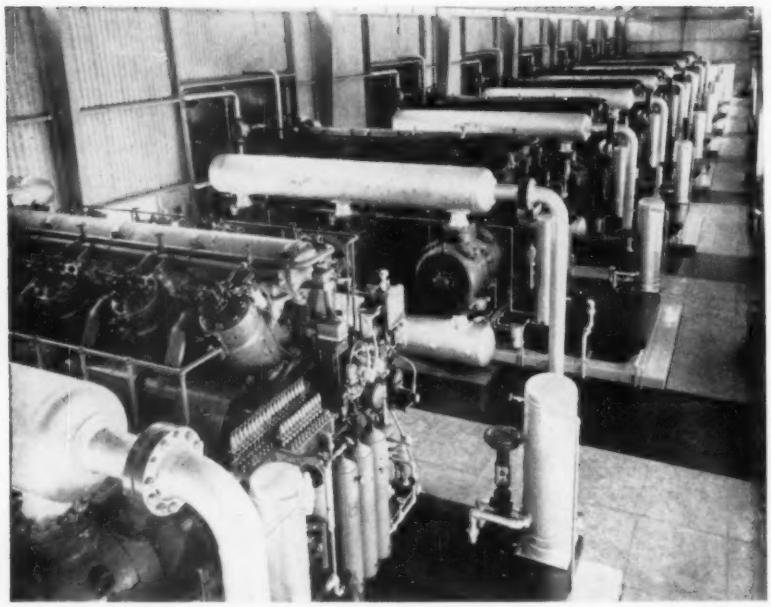
By E. N. SAMPSON, Controls Engineer
Cooper-Bessemer Corp., Mt. Vernon, Ohio

A SUCCESSFUL advancement in the automatic control of mainline compressor stations is in operation at the Franklinton Station of Southern Natural Gas Co. At this newest station, eight Cooper-Bessemer Type GMXD reciprocating compressors are being started, regulated and stopped by automatic control.

The compressor station installation of eight skid-mounted (packaged) units is for gas transmission service at 600 to 700 psig suction, and



En-tronic controls for Franklinton station handle starting sequence, regulation of output and shutdown of compressors through pre-determined automatic sequences.



Eight packaged reciprocating type compressors push the gas along at Southern Natural's Franklinton station.

800 to 900 psig discharge pressures. Of the eight compressors, five units are connected to 2 common headers known as the east suction. Three compressors are connected to both the east suction and a second or west suction line. This arrangement allows three of the eight compressors to draw gas from either or from both of the section header lines.

Located in a separate engine room, the eight unitized Cooper-Bessemer engine-driven compressors are individually controlled from the control center building 200 ft from the engine building.

The system sequence outlined here shows the steps of the control circuit pertaining to the dual suction compressor units. The dual suction units operate in the same sequence as the single suction units with, of course, the added choice of selecting a second suction for added station capacity if load demands so require.

Prior to starting a particular engine-driven compressor, indicator lights on the control panel show "on" for:

1. Power "on."
2. West or east suction "in circuit."
3. Blowdown open.
4. Bypass open.
5. Discharge closed.
6. East suction closed.
7. West suction closed.

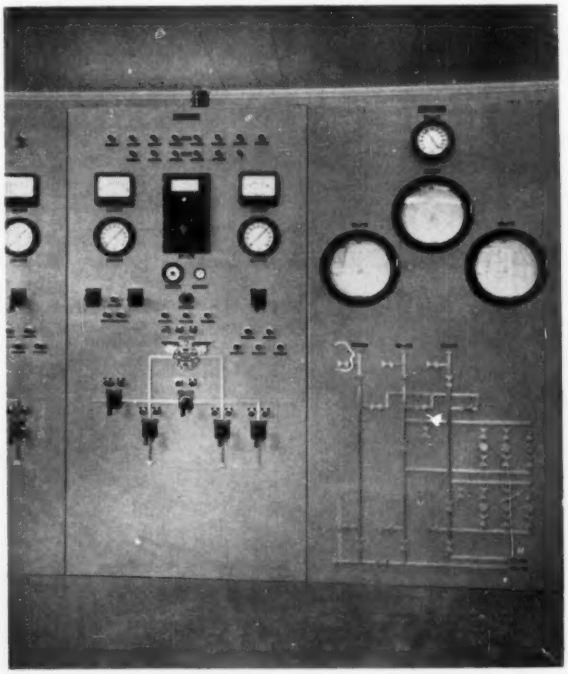
On actuating the single starting push button, the blowdown valve circuit is energized to close the blowdown valve.

When the blowdown valve completes close travel, the engine rolls over on starting air.

As the magneto-ground circuit is opened after a set purge time, the fuel control admits gas to the engine, the engine fires and begins to accelerate on fuel gas. The starting air is then shut off and the engine comes under governor control.

With the engine under governor control, the line discharge valve opens. At completion of the discharge valve opening travel, the chosen suction valve opens, and the bypass valve closes as the chosen suction valve completes its opening travel. The engine at this point is on the line and the controls are set so the engine is ready for speed regulation to meet the required conditions.

During starting and running, indicating lights show for—



Close-up view of a section of the control panel at Franklinton station.

1. Starting air on.
2. Ignition and gas on.
3. Suction valve travel.
4. Bypass valve travel.
5. Discharge valve travel.
6. Blowdown valve travel.
7. Chosen suction "in sequence."

In shutting down the engine, the following automatic sequence controls become actuated:

Upon initiating the "stop" button, the chosen suction valve begins its closing cycle, the bypass valve opens, the discharge valve closes. As the suction and discharge valves complete their travel, the blowdown valve opens. The engine continues to run on its set speed for a period of time. At the end of this time the fuel gas is cut off, and as the engine rolls to a stop, the ignition is grounded.

The visual system of pilot lights indicates to a checking attendant the status of the controls as the sequence progresses, and any condition for alarm or shutdown during operation.

Exceeding the set safe operating limits on any basic engine or compressor function is instantly indicated by the control system.

First, an alarm is signaled, then if the condition exceeds the set shutdown point, the unit is stopped and the particular cause is signaled.

Operating limits for alarm and shutdown conditions may be:

	Alarm	Shutdown
Control air pressure	X	X
Lube oil pressure	X	
Jacket water temperature	X	X
Jacket water pressure	X	
Gas discharge pressure	X	X
Gas suction pressure	X	X
Overspeed		X
Exhaust temperature	X	

Additional alarms and shutdowns may be added to cover the requirements of the particular installation.

Alarm or shutdown conditions are signaled to the dispatcher by means of audible and visual indication.

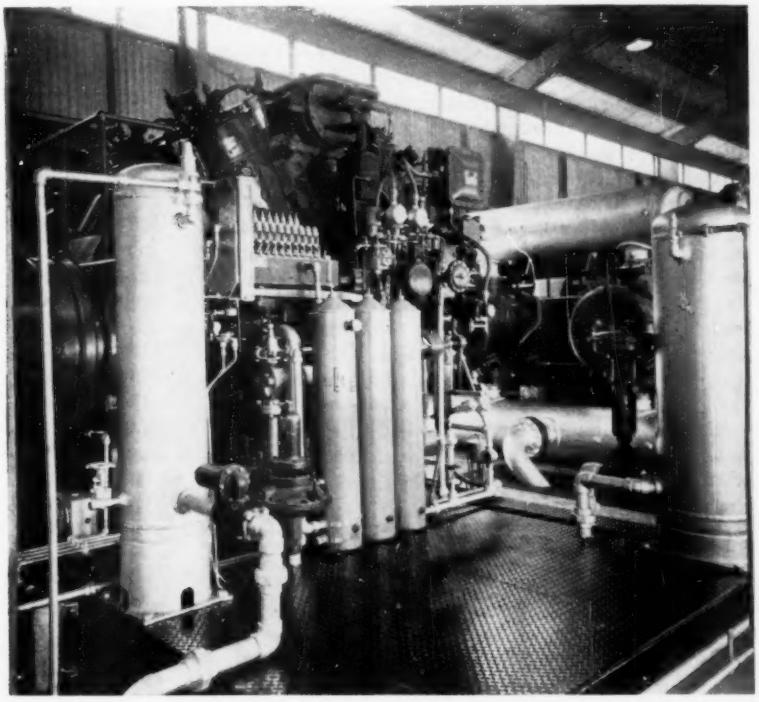
Alarm indications are self resetting when operating conditions return to normal.

Shutdown indications are maintained until the malfunction is corrected and the circuit is reset.

• Fail-safe protection

In event of power failure, or malfunction of any phase of the controls, the Cooper-Bessemer system automatically shuts down the entire operation and sequences all line valves, compressor and engine functions to initial start position. Only after malfunction conditions have been corrected and the system reset can a start-up take place.

The sequence circuit used at the Franklinton Station was developed by the Electronic and Control Division of the Cooper-Bessemer Corp. In conjunction with the Franklinton station, a similar system is installed at the Olga station of Southern Natural. Almost identical in design, Olga station, however, instead of being push button operated from 200 ft, is initiated through microwave from a control center situated approximately 53 miles from the compressor station. This control monitors for shutdown protection only; there are no alarm conditions. ■



Close-up of one of the packaged compressor units at Franklinton station.

WELDED REPAIRS on API 5LX52 pipe

By R. D. MOREL, Supervising Engineer
Transcontinental Gas Pipe Line Corp., Newark, N. J.

VERY often, the pressures of a fast-moving modern civilization will require that new procedures and products be developed and put into service at a very rapid rate. This rapid rate of development will tend to limit the preliminary research that can be accomplished prior to the actual use of the procedures and products involved. Thus, verification and improvement of procedures and products must take place simultaneously with their use. Additionally, the "in service" experience with a given product will instigate many research investigations that would probably have not even been considered in its development stages.

An example of this is the large volume of research presently being carried on by many different groups, the purpose of which is to evaluate and improve specifications for materials, welding procedures, manufacturing procedures, construction procedures, etc., for high-test line pipe. The purpose of this paper is to present a progress report on recent tests of welded repairs made on 5LX52 cold-expanded line pipe.

The problem as to why a crack, once initiated, would sometimes travel through several hundred feet of pipe in a failure was investigated under the sponsorship of AGA and the results of this investigation have defined within reason the conditions under which this type of failure is likely to occur. For example, when failure takes place at a temperature which is above the transition temperature* of the steel, the nature of the fracture is usually ductile; whereas in a failure that takes place at a temperature below the transition temperature of the steel, the nature of the fracture is usually brittle. Recognizing this fact and then comparing the rate of propagation of a crack under conditions varying between a completely brittle and a completely ductile type of fracture and considering the other significant features of such a test, such as the energy required to propagate the crack and the rate of pressure drop in the pipeline system, certain conclusions have been drawn from the results of the tests. Generally speaking, when failure occurs under ductile conditions, i.e., where transition temperature of the steel is lower than the temperature at the time of failure, the length of the failure will usually be confined to a very short distance. On the other hand, when a failure occurs under brittle fracture conditions, i.e., where transition temperature of the steel is higher than the temperature at the time of failure, the crack is apt to travel several hundred feet. Obviously, if a crack does not initiate in a pipeline, the problem as to how far it might travel does not exist.

The question that must be answered now is what causes these cracks or failures to initiate? The degree of defect of a notch has not yet been precisely evaluated, but it has been a well-established fact for years that the presence of a notch reduces the mechanical strength of the material. Until recently, a notch was not considered too seriously in structures where a fatigue problem did not exist. Normally, when speaking of a fatigue problem, we think in terms of millions of cycles of alternating stresses; and under fatigue conditions, the yield strength of the material is not satisfactory for design purposes, but instead, the endurance limit which is approximately one half of the ultimate strength is the design criteria. It is here that the effect of a notch becomes most serious since, when it is present under fatigue conditions, the effect of it is to lower the endurance limit of the material. Here again, the degree of defect that any given notch would have on the endurance limit is a relatively unknown factor.

Recently, strength-of-material investigations have introduced the concept of low-cycle fatigue failure; for example, any failure that might occur in a steel structure might be considered a low-cycle fatigue failure if it had been subjected to as little as two cycles of varying stress levels. We know that pipelines certainly are subjected to cyclic stresses due to varying pressures, stress variation due to temperature changes, and other secondary stress variations, and also that most of these cycles have a very low frequency. Applying this type of analysis to the performance of line pipe, it becomes evident that, *in the presence of a notch*, it is possible that line pipe may successfully contain a given pressure for a very long period of time but could ultimately fail at this same

* Transition temperature referred to here is the temperature at which a modified Charpy V-notch specimen exhibits an impact-energy level of approximately 15-ft lb.

pressure or even at considerably less pressure due to the aforementioned stress variation.

The performance of material in the presence of a notch is also affected by the brittle or ductile condition of the material which in turn is related to the aforementioned transition temperature of the material. For example, steel in a brittle condition containing a notch when stressed might fail at a stress level below the yield strength of the material due to the inability of the material at the root of the notch to yield. The effect of the notch here is to concentrate stresses at its root such that for any given set of conditions, the stress levels at the root of the notch would be greater than the stress levels in other cross sections in the material. When steel is stressed under ductile conditions, there is more opportunity for a local yield to take place at the root of the notch and thus relieve these concentrated stresses. Obviously, there are a great many things to be considered when attempting to evaluate the performance of line pipe for the widely varying conditions that it must operate under.

It may seem at first glance that the foregoing discussion is not related to the problem of making welded repairs on line pipe, however, a closer look will reveal that the making of a welded repair on line pipe includes an evaluation of the notch-effect problem and also consideration of the stress-concentration problem from the welding itself. In the first place, the thing that must be repaired is a notch of some kind. We therefore must decide whether or not the removal of any given notch by a welded repair will improve the performance of the material involved under stress. This is evidently not a very simple problem to analyze in detail.

The manufacturing specifications for API high-test line pipe provide that welded repairs may be made on defects within certain physical limitations and also that repairs must successfully undergo certain tests.

Referring specifically to grade X52 cold-expanded line pipe, welded repairs are allowable on defects when depth does not exceed 33 1/3 per cent of the tabulated wall thickness and where the length of that portion of defect that exceeds 12½ per cent is not greater than 25 per cent of the tabulated outside diameter of the pipe. The repaired areas must be hydrostatically tested to 90 per cent of the specified minimum yield strength. Only one repair is allowed along a length equivalent to 10 times the outside diameter of the pipe.

It should be noted here that the minimum yield strength of cold-expanded X52 line pipe is achieved due to the cold-working effects from cold expansion. This increase in mechanical properties due to the cold-working effects can be removed by heat treatment. At this point a great many questions may properly be asked regarding welded repairs on this pipe.

1. *What effect* does the high temperature produced by the welding have on the cold-worked mechanical properties of this pipe?

2. *What is the degree* and effect of welding stresses in the repaired areas?

3. *What effect* does the depth of repair have on questions 1 and 2?

4. *Are the present* limitations on welded repair too restrictive or not restrictive enough?

5. *In a borderline* case where depth of defect is 12½ per cent, would merely grinding smooth be more desirable than a welded repair?

Obviously, obtaining complete answers to questions such as these will require considerable investigation. It was felt that the initial investigation should determine that the specifications and limitations presently being adhered to are satisfactory with respect to insuring acceptable welded repairs. In order to accomplish this in as simple a manner and as short a time as possible, the first test consisted of several different types of repairs made on a single length of pipe. A description of the repairs is shown in *Table 1*.

The pipe used for this initial test was a length of 36-in. OD x .406 w.t. API 5LX52. The mechanical and chemical properties of this pipe are shown in *Table 2*.

In order to minimize the variables that would have to be evaluated, all of the repairs were made at locations opposite the longitudinal seam weld as shown in *Fig. 1*. An Audigage was used to determine the wall thickness of the pipe on a grid-pattern basis as shown in *Fig. 1* and also to check the wall thickness at each repair area before and after the repair was made. The welding was done using a 5/32 in. low-hydrogen electrode, and sufficient weld metal was added so that after grinding the repair area smooth, no notches were left on the edges of the repairs due to undercuts or bead shapes. Grinding was accomplished in a manner that would nearly as possible

TABLE 1

Repair No.	DESCRIPTION OF REPAIRS
1.	Chipped 9-in. long x .375-in. wide x .135-in. deep. Inside wall. Welded and ground flush.
2.	Chipped 9-in. long x ⅜-in. wide x .135-in. deep. Outside wall. Welded and ground flush.
3.	Chipped 3-in. long x 1-in. wide x .135-in. deep. Inside wall. Welded and ground flush.
4.	Chipped 3-in. long x 1-in. wide x .135-in. deep. Outside wall. Welded and ground flush.
5.	Chipped 9-in. long x ⅜-in. wide x .051-in. deep. Outside wall. Welded and ground flush.
6.	Chipped 9-in. long x ⅜-in. wide x .051-in. deep. Outside wall. Ground smooth. (This was point of fracture)
7.	Chipped 3-in. long x 1-in. wide to 60 per cent depth, welded, from both the outside and inside surfaces.

TABLE 2

Chemical analysis	.22C	1.00Mn	.011P	.03S
Transverse yield strength			59,400 psi	
Transverse tensile strength			83,250 psi	

restore the original contour of the pipe wall. Repair No. 7 consisted of the complete removal of the pipe wall and the replacement of it with weld metal. This type of repair is not allowable under the manufacturing specifications, but it was felt that it would be a useful thing in helping to evaluate as severe a repair that might ever have to be made.

Repairs Nos. 5 and 6 were made for comparison purposes. The defect in both areas was identical or very nearly so—each one consisting of a groove 9-in. long and 12½ per cent of the wall thickness in depth. Under the manufacturing specifications, this type of defect is a borderline case in that it can be removed by grinding. Therefore, in order to compare the relative merits of a welded repair on a defect such as this to merely grinding it smooth, repair No. 5 was welded and ground smooth, and repair No. 6 was ground smooth with no welding.

In an attempt to obtain information with regard to the individual stresses and strains occurring in each repair area for any given pressure, Baldwin SR4 strain gages were applied to each repair. Single-grid gages were used to measure strains in a circumferential direction only. Pressure was increased in increments as shown in *Table 3*, and strain-gage readings were taken at each of these points.

An additional strain-gage reading was taken after sufficient water had been introduced to produce a 2 per cent volumetric offset, and the pressure at this point which by definition is the yield pressure of the test was determined to be 1400 psig. The pressure was then raised until the test joint burst. The burst pressure was 1775 psig. The fracture initiated in repaired area No. 6. The total length of the fracture was 78 in. and the minimum thickness at the point of initiation was .32 in. Examination of the surface indicated approximately 4 in. of cleavage or brittle fracture at the point of initiation with the remainder indicating a shear or ductile type fracture. Area No. 6 was the area that no welding had been performed on, but the notch had been removed by merely grinding smooth. The results of the strain-gage data and the burst-test data have been plotted and are shown in the Appendix. The strain-gage data includes a theoretical strain-stress curve based on the actual wall thickness at each test area for reference purposes.

Some observations may be made and some conclusions might be drawn from the information presented herewith, but the validity of such conclusions would necessarily require supplemental investigation. However, there is one obvious fact as the result of these tests, and that is, that all of these welded repairs and also the repair that was merely ground smooth performed satisfactorily under the testing as required by the manufacturing specifications. There is evidence of some local yielding in some of the repaired areas at stress levels lower than the theoretical minimum yield. This is particularly true of area No. 7 where the entire wall thickness was replaced with weld metal. This local yielding is probably due to the welding stresses. We do not have sufficient information here to evaluate the level of the welding stresses; however, it is reasonable to assume that as the internal pressure is raised and as the stress level increases due to this pressure, at some point the pressure stress and the welding stress will combine to the extent that they exceed the yield strength of the material; and at such time, this local yielding will take place. Under a condition such as this, here again it is important that the repaired areas be completely free of any physical notches and that they possess sufficient ductility to allow this yielding to take place in a manner that will not initiate failure. Another effect of this local yielding would be to relieve the locked-in stresses due to welding and also to cold work the material.

Future investigations should be designed to determine more in detail what the performance of repaired areas such as these would be under repeated cycles of stressing without exceeding the theoretical minimum yield of the material. There is some indication here that the deeper the repair, the higher the welding stresses. But again, we cannot evaluate this quantitatively.

I believe it is reasonable to state that a welded repair can be made satisfactorily to a much greater degree than is presently allowable if the proper repair procedure is used, and subsequent research should be designed to investigate this possibility. ■

Appendices A, B, C, D, E and F appear on pages 102, 103 and 104.

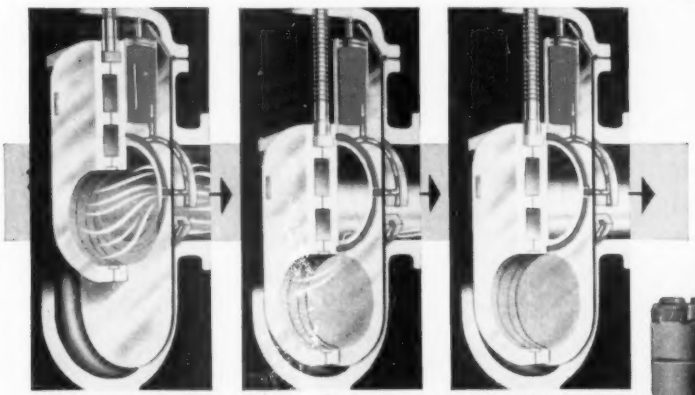
TABLE 3

STRAIN-GAGE DATA POINTS

Reading No.	Pressure	% Min. Yield	Theo. Stress
1	0	0	0
2	468	40	20,800
3	842	72	37,440
4	1060	90	46,800
5	1172	100	52,000

For pipeliners who hate leaks!

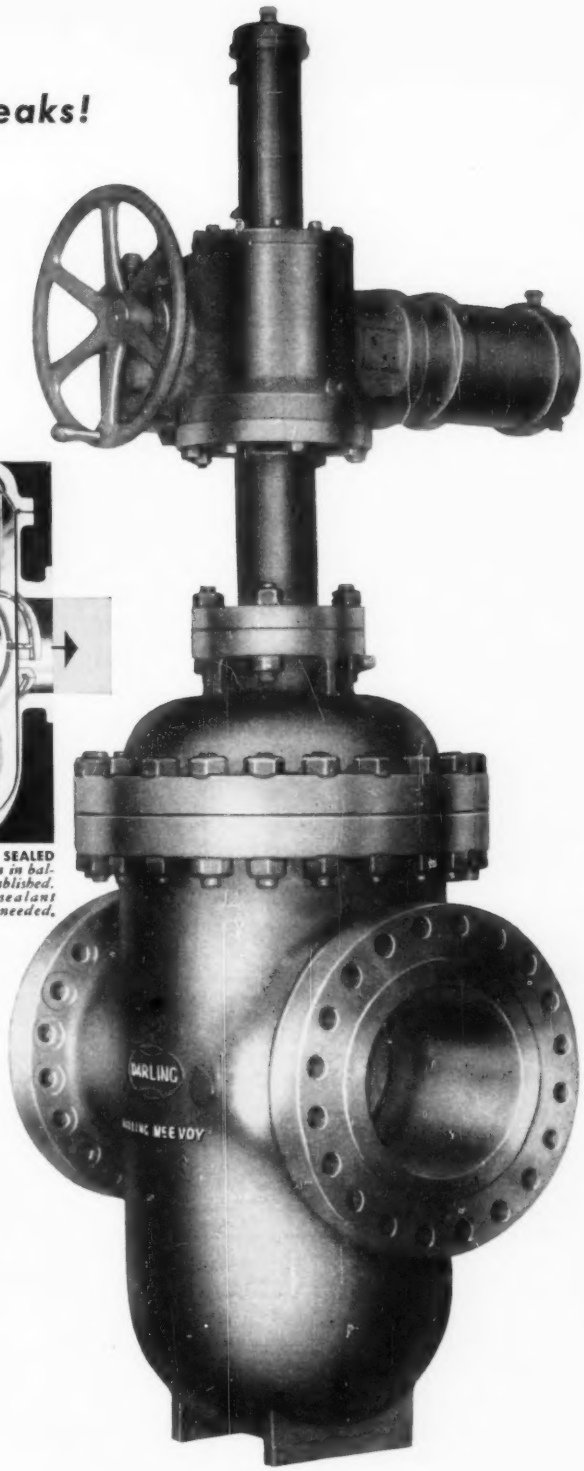
DARLING-McEVOY SELF-SEALING CONDUIT VALVES



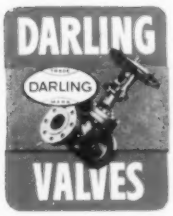
APPROACHING CLOSURE ... *No loss of sealant as sealing groove in seat is disconnected from reservoir until gate is fully closed.*

CLOSED ... *Jumper in gate now permits differential pressure to feed sealant into seat groove to check any remaining flow.*

AUTOMATICALLY SEALED ... *Pressures again in balance. Tightness established. No additional sealant used until again needed.*



THE DIAGRAMS above show how these unique conduit gate valves seal themselves *automatically* . . . by means of a long lasting reservoir-held sealing compound . . . for leak-proof, pressure-tight closure every time! This feature, with flow in either direction, self-aligning non-wedging gates, and fully protected non-distorting seats, means exceptional performance, utility and service life. For additional information on these fully field-proved Darling-McEvoy valves, ask for Bulletin 5402.



DARLING VALVE & MANUFACTURING CO.

Williamsport 26, Pa.

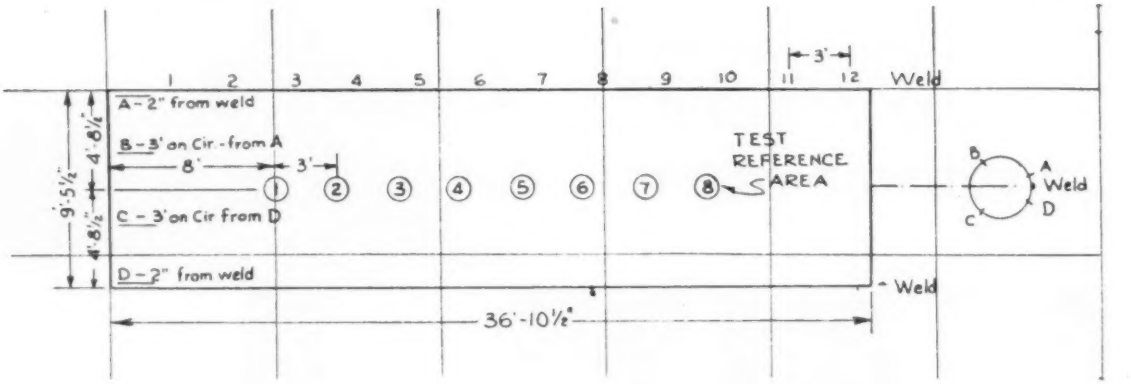
Manufactured in Canada by Sandilands Valve Manufacturing Company, Ltd., Galt 19, Ontario

APPENDIX

Appendix A (Fig. 1)

No. 1 End
CHECK READING: AUD. .408"
MIC. .409"

No. 8 End
CHECK READING: AUD. .418"
MIC. .419"



	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
A.	.400	.400	.405	.405	.405	.405	.405	.405	.407	.405	.407	.405
B.	.414	.414	.415	.415	.415	.415	.414	.414	.415	.415	.415	.415
C.	.414	.414	.415	.414	.414	.414	.414	.414	.414	.414	.414	.414
D.	.400	.405	.405	.405	.405	.405	.401	.400	.400	.400	.403	.397

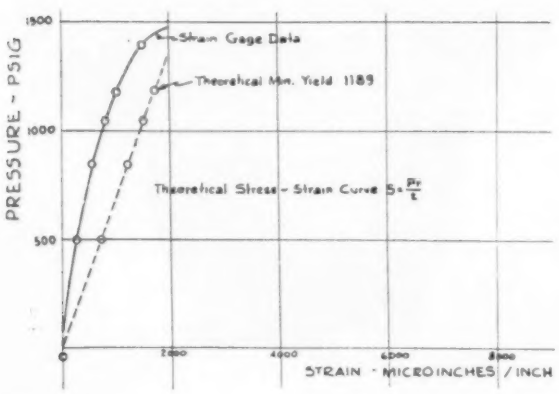
PLATE THICKNESS ALLOWABLE:
(.406 x .10=) .365" W.T. Under
(.406 x .15=) .460" W.T. Over

THICKNESS AT TEST AREAS:

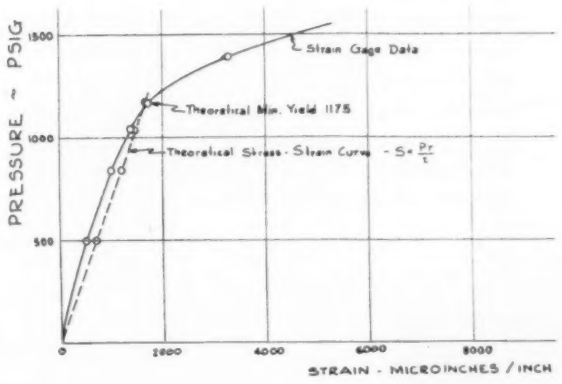
	Before Repair	After Repair
1.	.421"	.412"
2.	.421"	.407"
3.	.421"	.409"
4.	.421"	.420"
5.	.418"	.412"
6.	.418"	.360"
7.	.419"	.409"
8.	.418"	(No repair)

Appendix B on facing page.

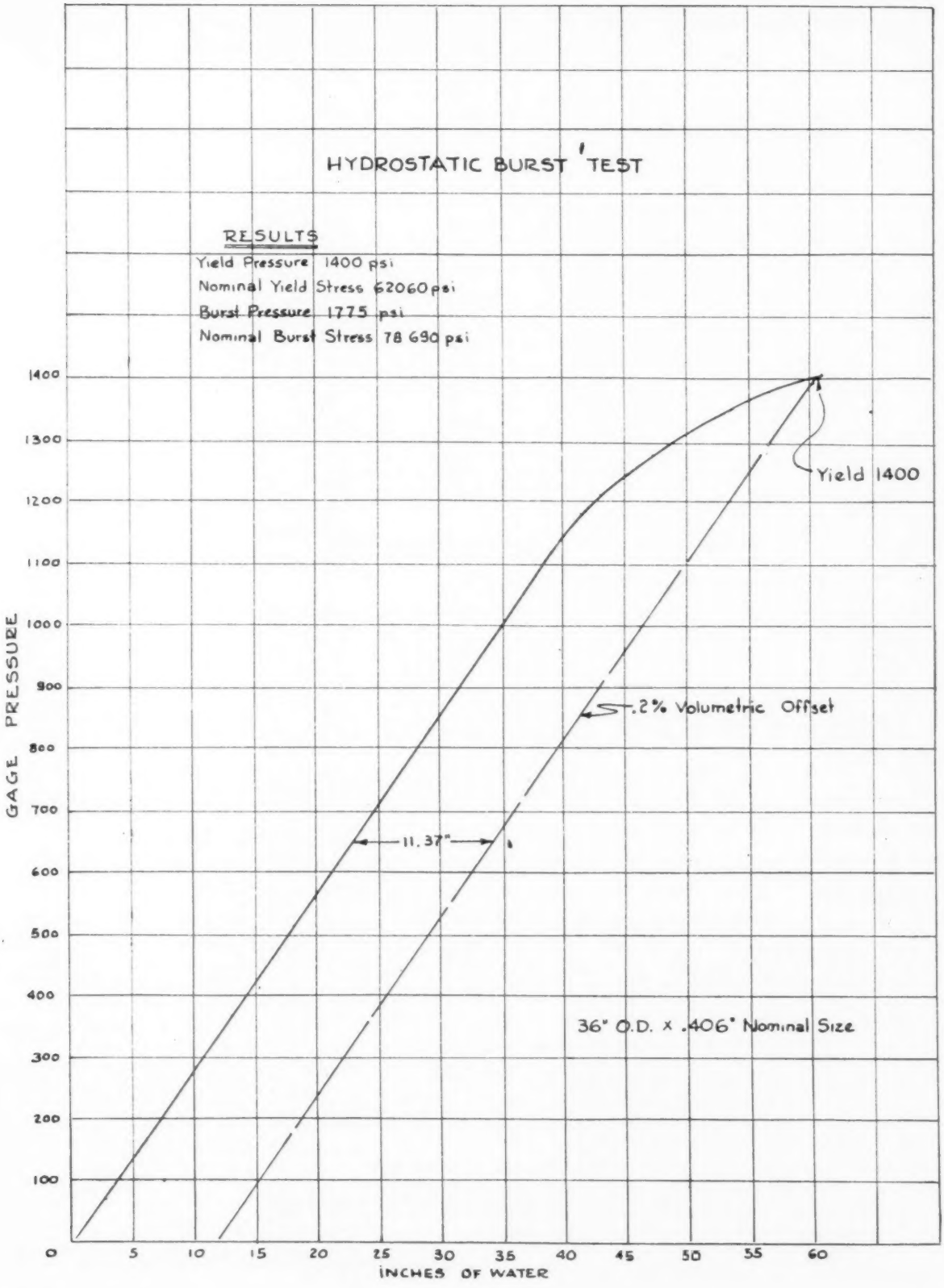
Appendix C



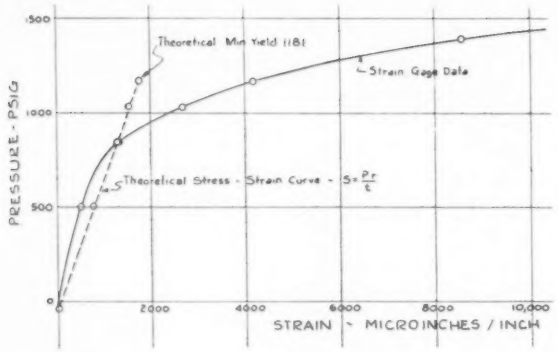
Repair No. 1
Location: 8 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 9-in. long x .375-in. wide x .135-in. deep on inside wall—welded and ground flush.
Wall thickness: Before repair .421; after repair, .412.



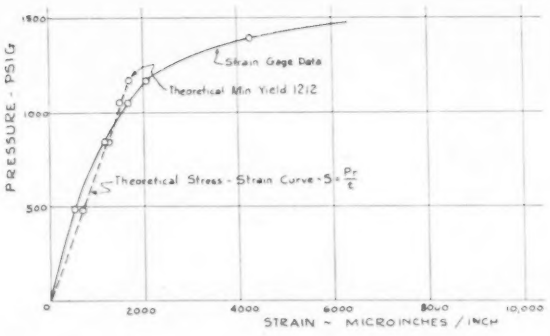
Repair No. 2.
Location: 11 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 9-in. long x .375-in. wide x .135-in. deep on outside wall. Welded and ground flush.
Wall thickness: Before repair .421; after repair .407.


HYDROSTATIC BURST TEST
RESULTS
Yield Pressure 1400 psi
Nominal Yield Stress 62060 psi
Burst Pressure 1775 psi
Nominal Burst Stress 78 690 psi
Yield 1400
.2% Volumetric Offset
11.37"
36" O.D. x .406" Nominal Size
GAGE PRESSURE
INCHES OF WATER
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
5
10
15
20
25
30
35
40
45
50
55
60

Appendix D

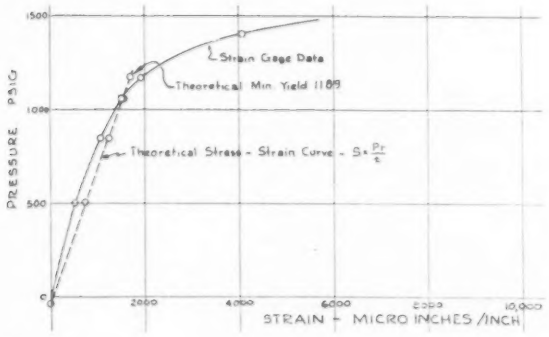

Theoretical Min Yield 1181
Strain Gage Data
Theoretical Stress - Strain Curve - $S=\frac{Pr}{t}$
PRESSURE - PSIG
STRAIN - MICROINCHES / INCH

Repair No. 3
Location: 14 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 3-in. long x 1-in. wide x .135-in. deep on inside wall—welded and ground flush.
Wall thickness: Before repair .421; after repair .409. .....

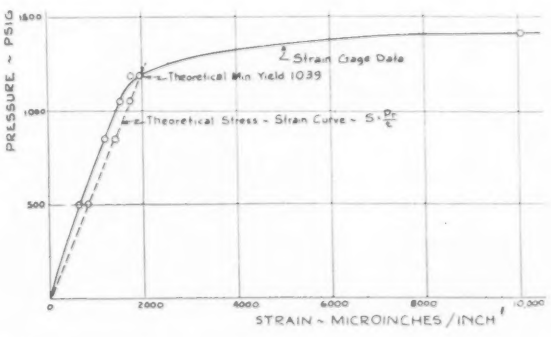

Strain Gage Data
Theoretical Min Yield 1212
Theoretical Stress - Strain Curve - $S=\frac{Pr}{t}$
PRESSURE - PSIG
STRAIN - MICROINCHES / INCH

Repair No. 4
Location: 17 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 3-in. long x 1-in. wide x .135-in. deep on outside wall—welded and ground flush.
Wall thickness: Before repair .421; after repair .420.

Appendix E

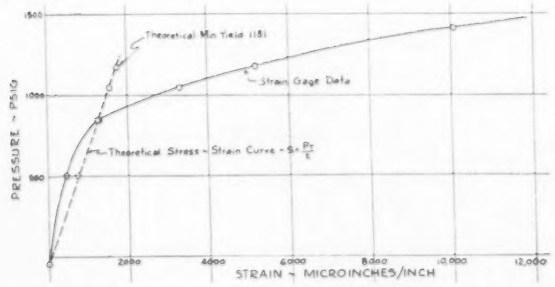

Strain Gage Data
Theoretical Min. Yield 1189
Theoretical Stress - Strain Curve - $S=\frac{Pr}{t}$
PRESSURE - PSIG
STRAIN - MICRO INCHES /INCH

Repair No. 5
Location: 20 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 9-in. long x .375-in. wide x .051-in. deep outside wall—welded and ground flush.
Wall thickness: Before repair .418; after repair .412.

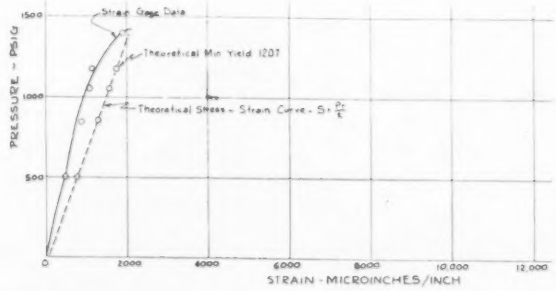

Strain Gage Data
Theoretical Min Yield 1039
Theoretical Stress - Strain Curve - $S=\frac{Pr}{t}$
PRESSURE - PSIG
STRAIN - MICROINCHES / INCH

Repair No. 6
Location: 23 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 9-in. long x .375-in. wide x .051-in. deep on outside wall. No welding. Ground smooth and contoured to eliminate sharp changes in direction.
Wall thickness: Before repair .418; after repair .360.

Appendix F

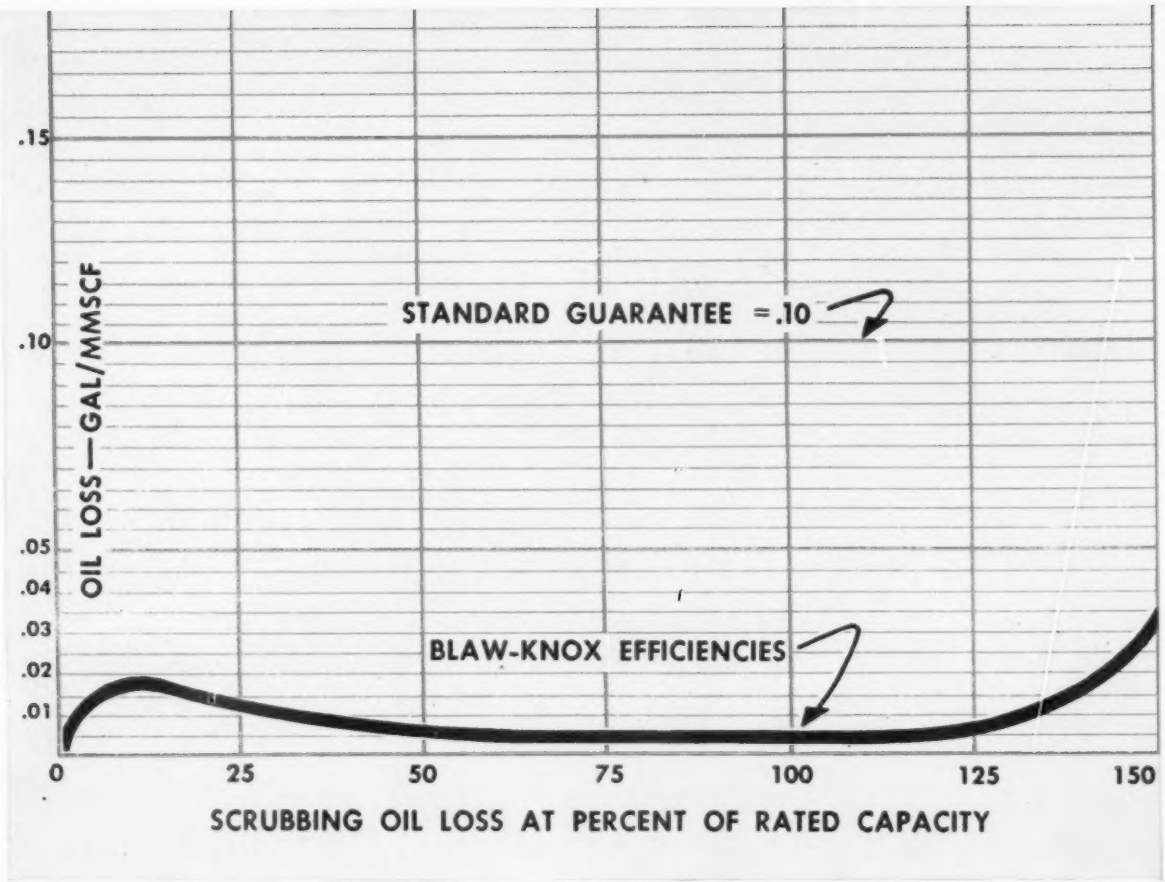

Theoretical Min Yield 1181
Strain Gage Data
Theoretical Stress - Strain Curve - $S=\frac{Pr}{t}$
PRESSURE - PSIG
STRAIN - MICROINCHES/INCH

Repair No. 7
Location: 26 ft from weld cap—180 deg. from longitudinal seam weld.
Description: Groove 3-in. long x 1-in. wide. 60 per cent of wall thickness removed from outside and welded—same procedure on inside giving all weld metal. Ground flush inside and outside.
Wall thickness: Before repair .419; after repair .409.


Strain Gage Data
Theoretical Min Yield 1207
Theoretical Stress - Strain Curve - $S=\frac{Pr}{t}$
PRESSURE - PSIG
STRAIN - MICROINCHES/INCH

Repair No. 8
No repairs
Wall thickness: .418.

This article was adapted from a paper presented by Mr. Morel at the 13th Annual Petroleum Mechanical Engineering Conference, Denver, Colo., September 24, 1958.



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For top economy in pipe line construction and operation, you can rely on Bethlehem Steel Line Pipe. Let our nearest sales office quote on your requirements.

	SIZES (in., OD)	WALL THICKNESSES (in.)	LENGTHS	SPECIFICATIONS
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ELECTRIC RESISTANCE-WELD	5 (nom) to 16	API	to 60-ft	API 5L, Grades A & B API 5LX, Grades X42 & X46
CONTINUOUS BUTT-WELD	½ to 4 (nom)	API	SRL 24 to 26-ft DRL to 50-ft	API 5L
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① Expanded after two 20-ft lengths are joined with girth weld.				

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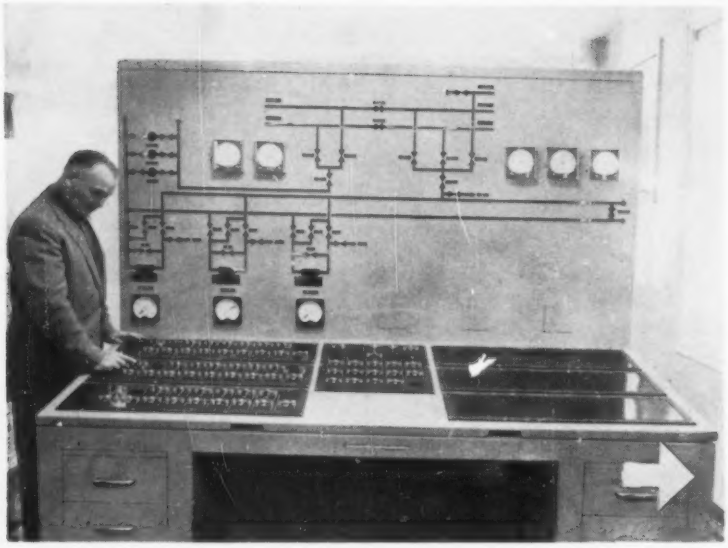


"Brain" of the new unmanned Texas Eastern station (below) is the remote control board (left) at the Lambertville station, 50 miles upstream.

Linden plant proves there's safety in remote control

TEXAS Eastern Transmission Corp. expects to prove this winter that a compressor station which is only intermittently needed for peak-load operation can be operated better and more safely by remote control than by local actuation.

Remote control is having its first operational tryout in the company's system at the new Linden, N. J., station. This plant, which is a "tail-end" installation will go on stream for the first time when the cold weather hits. It will be controlled from the Lambertville, N. J., station, located some 50 miles upstream, near the Pennsylvania-New Jersey state line.

A. J. Shoup, vice president and chief engineer, lists "safety, efficiency and dependability" as three characteristics of this station.

"At the present time, this type of remotely operated station has one major advantage over manned stations," he told representatives of the trade press during a plant tour in November. "A station operated by automatic equipment eliminates the possibility of human error."

Functions normally actuated manually are done automatically at Linden. Main valves automatically close in case of line breaks. Pressurizing and vent valves for the gas-operated operators are automatically opened and closed in proper sequence by means of solenoid valves controlling the pressure to the operators. Electric power failure automatically closes the valves.

Engine controls are also actuated by solenoids in place of manual operation. Supporting functions such as adjustment of cooling water valves are performed by valve operators.

Potentially hazardous conditions can also be detected and corrected through instrumentation. An unauthorized visitor will immediately make his presence known to the Lambertville personnel. So will a dangerous accumulation of gas in the plant.

A second advantage of the remote operation is the elimination of a major manpower headache. Manual control would require that highly trained men be brought in for short periods, sometimes for only a day or two at a time. Most of the year they would need to be used elsewhere. Sudden changes in the weather might catch the company unprepared unless elaborate standby procedures were set up.

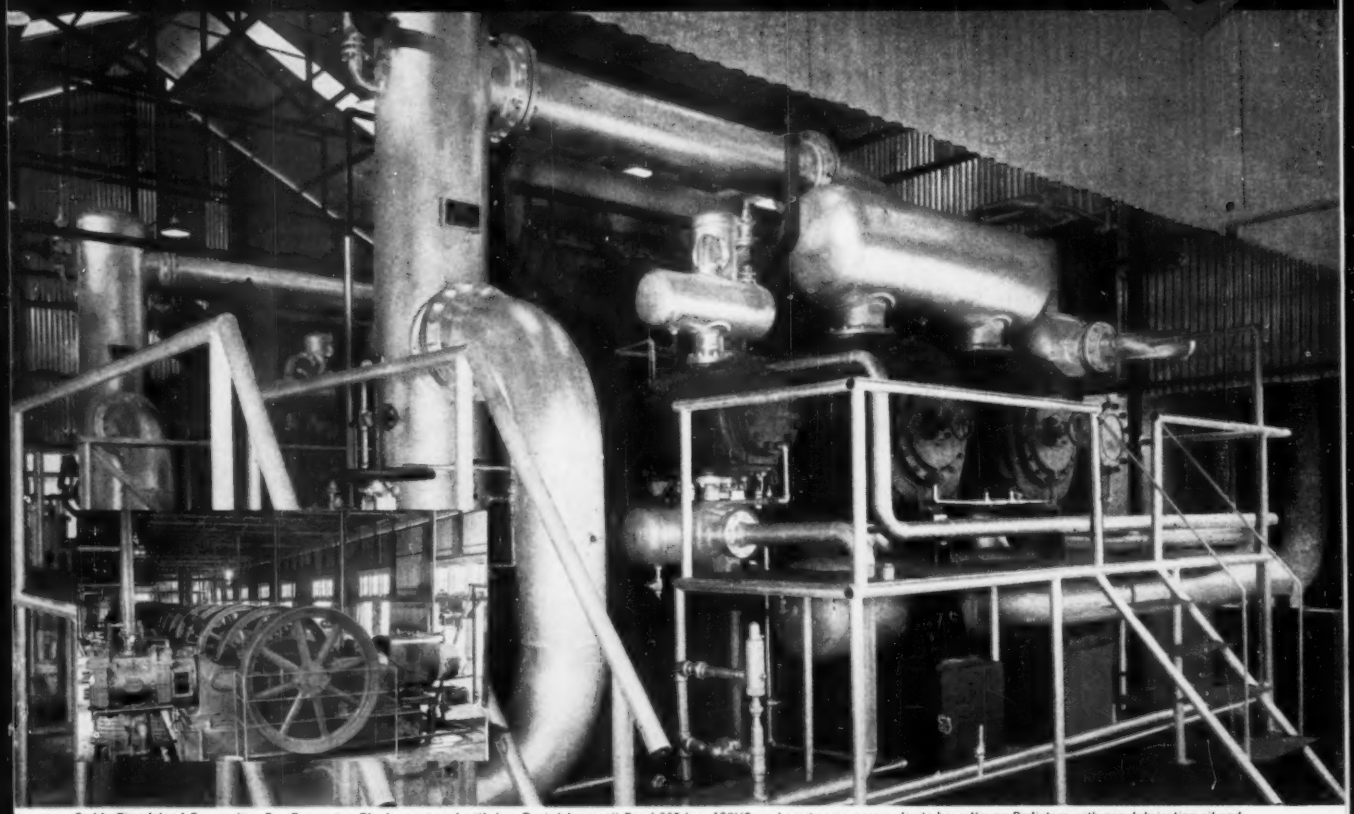
As it is, Texas Eastern uses only one man, and he on a single daytime shift, to maintain the station. He is employed there on a year-around basis.

Not only is the station independent of human error; it is also as nearly self-sufficient as possible. Power line outages will not interrupt its operations, because an emergency generator has been installed for standby use. Hydraulic drives rather than electric are used to run the jacket water cooling units.

Operating flexibility has been achieved by setting the engines for operation through a speed range of 60 per cent to 110 per cent of nominal rating. Three

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



Caddo Pine Island Corporation Gas Processing Plant—equipped with two Beaird-Ingersoll-Rand 660 h.p. 12SVG packaged compressors. Units have Young Radiators with gas, lubricating oil and engine water cooling sections. Other sizes 120 to 660 h.p. Inset picture shows original horizontal compressors.

Two Packaged Compressors

DO WORK OF TWENTY OLDER UNITS

Caddo Pine Island Corporation processes flare gas from 1,000 Pine Island Field wells in an absorption plant located near Oil City, Louisiana. Picking its load up over a thirty mile gathering system, the plant was originally equipped with twenty horizontal compressor units. These have now been replaced by two Beaird-Ingersoll-Rand 12SVG 660 h. p. packaged compressors.

Using three stages of compression the packaged units pull the gas into the plant under ten inches of vacuum. It is then boosted through processing operations and returned for third stage boosting to the sales line. Up to 5¼ million cubic feet can be handled per day with final delivery pressures of 440 psi.

Installation of modern Beaird packaged compressors has increased plant dependability and lowered fuel, labor and maintenance costs. An additional savings will be realized when the field is depleted. Installation of packaged compressors has made the station almost wholly salvable.

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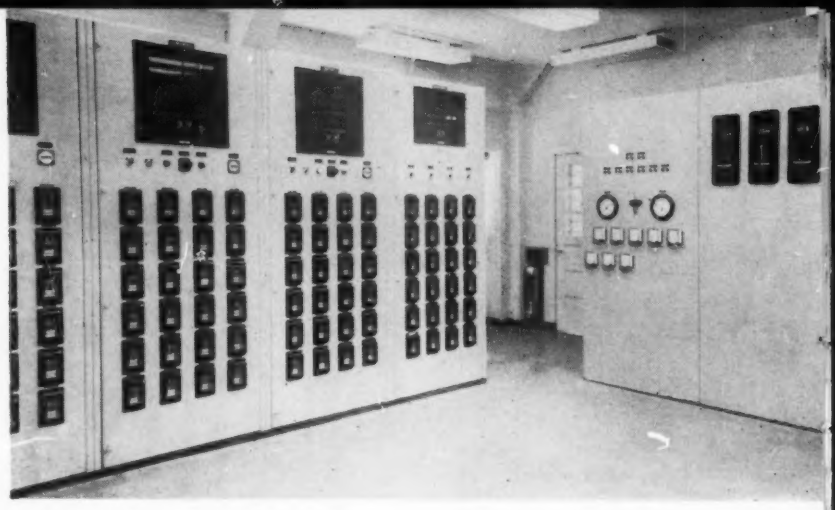


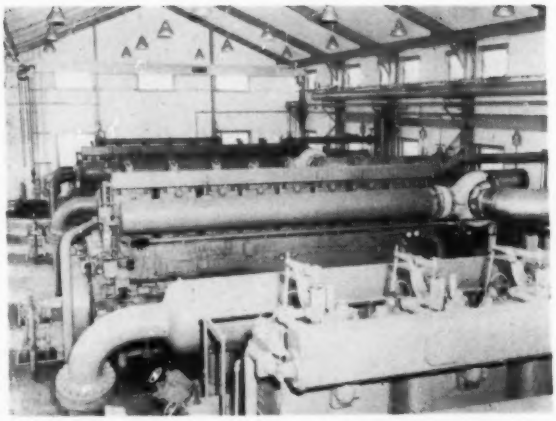
With control removed to the Lambertville station, instrumentation in Linden's control house is simple. At left is the sequence panel. At right is the supervisory control board.

2000-hp Clark reciprocating compressors were used in preference to gas turbines, which would have been too large for the job requirements. Electrically driven turbines were ruled out because of the excessive cost of power in a low load-factor operation.

The station was designed to carry out Texas Eastern's "good neighbor" policy. Even though there are no homes in the immediate vicinity, the company took what measures it could to keep the noise level down. The engines are equipped with turbochargers, which eliminate the need for scavenging. Each one is equipped with a pulsation bottle to reduce pounding. Only four blowdowns of large size were installed, further cutting down on noise.

This station is a prototype for future remotely controlled stations on the Texas Eastern line. Therefore, certain operations are carried on in two different ways to test the relative efficiency of each. Certain indicating instruments, for example, are hydraulically actuated while others function on an electric signal. The remote control signal from Lambertville may be carried on either microwave or a direct telephone line.

Experience gained in this station will help establish the design of four additional stations which Texas Eastern is planning to build on the Penn-Jersey line, which runs from Pittsburgh across Pennsylvania to a connection with the main line at the Lambertville station. This line is a key supply link in the company's winter peak distribution program. It carries large volumes of gas from the all-important Oakford storage field in western Pennsylvania, and these volumes will be stepped up shortly through the addition of a central Pennsylvania underground storage point.



These three reciprocating engines proceed through the entire start, stop, and run sequences at command signals from Lambertville.

F. Vinton Long, Texas Eastern's communications expert, explains the workings of the remote system for the benefit of members of the trade press.

To Texas Eastern, the remotely controlled station is an ideal type for use in these intermittent, peak-load supply situations. Linden is the prototype. But, looking further into the future, it may have an even deeper significance in long-range compressor station design.

As F. Vinton Long, chief of the communications section of the Texas Eastern engineering department, says,* "The ultimate goal of remote-operated stations is to provide facilities for a centrally controlled pipeline. This would be a system whereby one operator could dispatch the maximum throughput of gas through a pipeline with a minimum of downtime and reduce maintenance of the system."

* See "A Philosophy of Tele-trol of Reciprocating Gas Engine Compressor Units," by F. Vinton Long, GAS, November 1958, page 100 et seq. In this article, Mr. Long discusses the basic concepts of a remotely controlled station and shows how they were applied to the design of the Linden station. The article also describes the control equipment and traces the sequence of events in the operation.

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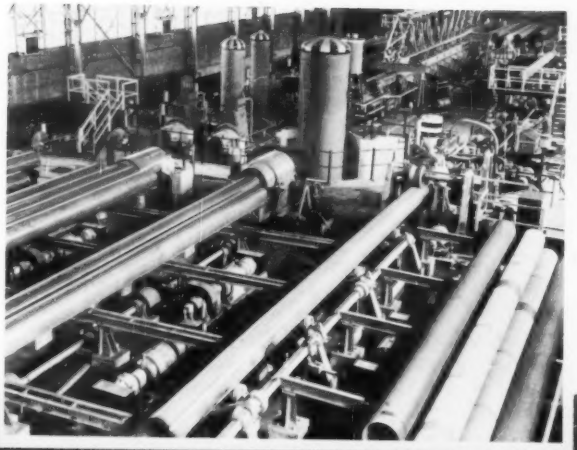

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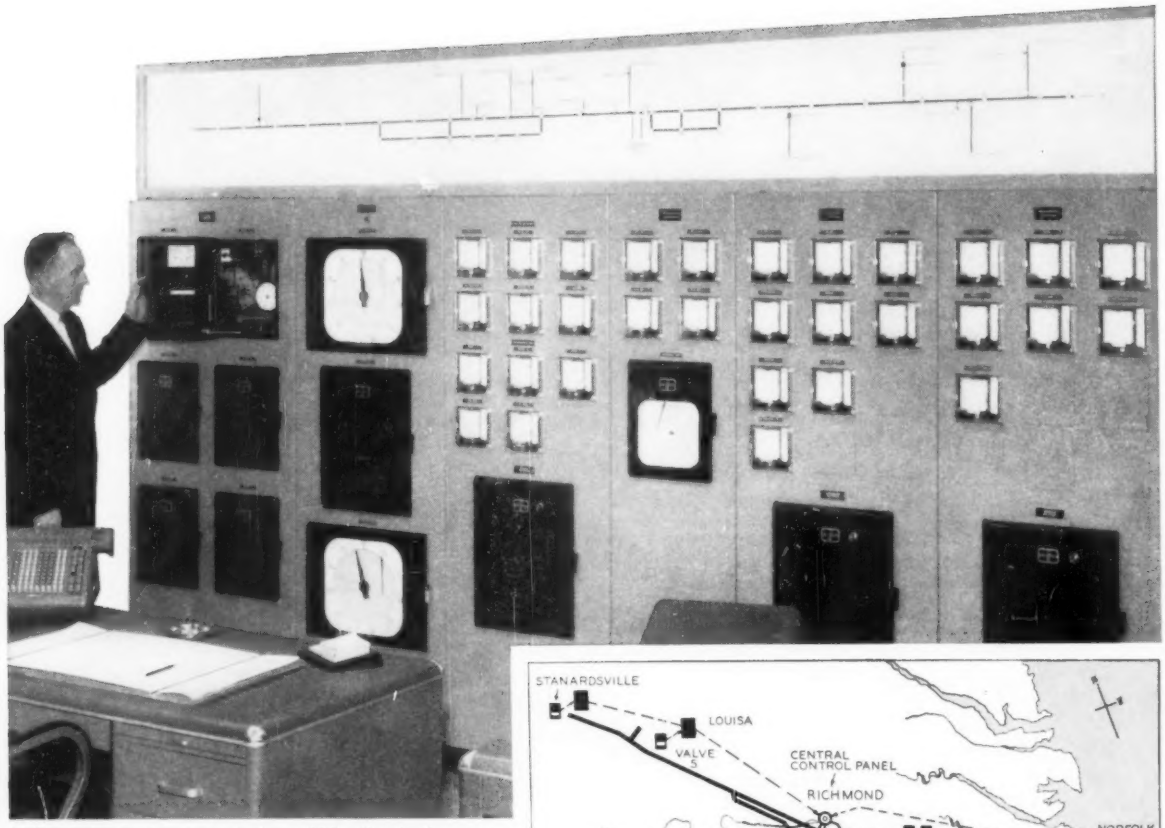

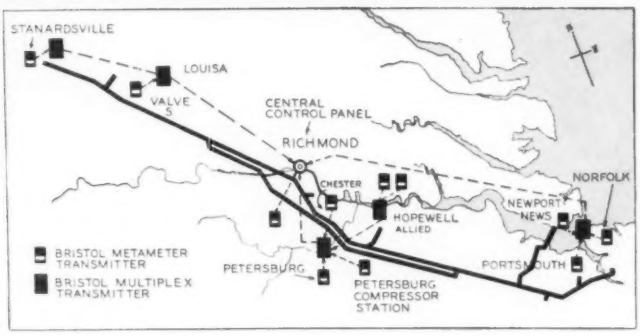

Schematic in top panel shows 300-mile pipeline system controlled by 31 Bristol miniatures, 13 full-sized Bristol instruments below. Map shows system ranging from Stanardsville in Northwest to Norfolk in Southeast Virginia.

Dispatcher's-eye view of a complex 300-mile pipeline system

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*T.M. Reg. U. S. Pat. Off.

From this panel of Bristol Metameter* telemeters, dispatchers at the Commonwealth Natural Gas Corporation of Richmond, Va., monitor natural gas supplied to the City of Richmond, The Petersburg and Hopewell Gas Company, The Virginia Electric & Power Company in Norfolk and Newport News, The Portsmouth Gas Company and several large industrial users, and also control the operations of the corporation's compressor station near Petersburg.

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BRISTOL *TRAIL-BLAZERS IN PROCESS AUTOMATION*

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Communications and Automation

Edited by FRANK CHAPMAN

The missing link

By F. VINTON LONG

OVER and over and over again I have been preaching for just one thing.

That thing is a simple "black box" microwave repeater.

We still don't have it, although the French are coming close with their field set with the funny-looking antenna, and the telephone microwave suppliers are DC minded.

I have tried to work up one, but it ain't easy on a part-time no-budget basis.

However, I think the time has come to bring out in bold type one fact, "WE HAVE EVERYTHING AVAILABLE NOW FOR AN AUTOMATIC PIPELINE EXCEPT COMMUNICATION LINKS THAT WILL STAY PUT, REGARDLESS OF WEATHER."

I have made the statement before that a pipeline or utility these days can install its own microwave system which will provide more adequate telecontrol service than the common carriers can ordinarily provide. Please note that I mean economically provide as a standard service. I know that the common carriers have the brains and the resources to provide anything we need and I hope they stay in business because I have seen too many nationalized communication services.

The rub comes in that this privately owned adequate communication channel provided for an automatic pipeline is many times so burdensome and complicated that through excessive maintenance cost it defeats its own purpose.

So we are right back where we started.

We have no problem with the terminals.

We do not have a decent microwave black box battery-operated one-voice channel microwave repeater.

We have color TV and automatic auto transmissions, thousands of good engineers, and billions for R & D, but still no decent repeater.

It's like the cure for the common cold.

Without this decent low-channel density repeater, microwave will never find its true place in the pipeline and utility business.

What can we do? Well, maybe we can join forces. We know that any manufacturer that works on one without anticipation of a market would resemble the president of G. M. saying they would build nothing but Volkswagens.

But there is a need for this device, and maybe if the AGA, the API, the AAR, and the military did jointly feel that they could benefit from a good simple repeater, they could also jointly shell out some money to speed up its development.

I hope that interested parties will sound off.

* * * * *

JUST suppose we plunk down $100 million to build ourselves a new gas pipeline.

Let's arbitrarily assume that this system is capable of operating over a year's time at an average of 97 per cent of its design capacity. Therefore, we have spent 3 per cent of that $100 million, or $3 million which we wish we didn't have to for facilities which we have assumed will not be available for use.

It is apparent that our immediate concern is how can we recover any portion or all of that 3 per cent. What can we do to make that $3 million work for us?

Now suppose we install a good communication and control system which would recover two points of the 3 per cent. This might cost us $1 million. However, we have picked up 2 per cent or about $2 million by this investment.

Looking at it the other way, suppose we figure the $1 million communication-control investment at $150 thousand for fixed charges, plus $200 thousand to operate, or say about $350 thousand total annual cost.

The annual cost of the $2 million investment which we now recover by better utilization of what we did build would be $300 thousand.

So right here we are $50 thousand ($350 thousand less $300 thousand) worse off than if we forgot the whole thing. But we would have had some sort of communications, anyway. So, assuming that the very minimum of communication facilities, not heavy enough for remote control links, would cost $100 thousand yearly, we can balance this against the first-class job and come out with a net saving of $50 thousand yearly.

And we must bring in another thing—cost of power and fuel for transmission. On a $100 million large delivery line this might run $2.5 million. You don't quite take 2 per cent of that ($50 thousand) as a net saving because of better control, for you will have to pay fuel and power cost for the extra gas transmitted. However, this extra gas can be sold and this increased revenue will pay for transmission cost plus some profit.

Add to all this the increased personnel efficiency obtained through good telecontrol and we might pick up about $100 thousand in that area. The whole thing counts up.

This is what I call the positive attitude. ■

GAS • PIPELINE NEWS

New gas supplies planned for Midwest as commission turns down "2306 et al"

By NEIL REGEIMBAL
GAS Washington Bureau

The groundwork is set for fairly quick approval of some new projects to bring huge additional supplies of natural gas to Chicago and the upper North Central states.

The Federal Power Commission, in turning down all competing plans to serve the area with "profound regret," invited new proposals for redesigned projects which would meet the defects found in the first round.

They were quick in coming. On the first working day after the proposals were rejected, the Midwestern Gas Transmission Co.-Tennessee Gas Transmission Co. combination told the commission it would file two new applications to serve the markets in the gas-hungry area involved.

Midwestern asked approval of a plan to build a pipeline to bring 360 MMcf daily to the Chicago-Gary area, with Tennessee supplying the gas in the Deep South. A second application will call for a pipeline from the originally planned connection with Trans-Canada Pipelines Ltd. at the Minnesota border to serve that state, Wisconsin, the upper Michigan Peninsula, and parts of North Dakota.

Unlike the original Midwestern proposal, the two pipelines would not be interconnected—at least initially. Midwestern officials said they were talking with officials of another unsuccessful applicant, Northern Natural Gas Co., as well as other firms, in the hope that they would participate in the import project.

In turning down the Midwestern, Northern Natural, and Michigan Wisconsin Pipe Line Co. proposals to serve the upper North Central states area, the commission backed the principle of importing Canadian gas to this country to the hilt.

A massive future network of interconnected pipelines ranging from the Mexican border to deep within the Canadian gas-producing provinces was sketched by the FPC. This, gas industry experts said, was the most important aspect of the FPC decision in the case.

In turning down the pending applications, the FPC settled all major issues involved in the three-year-old controversy except which firm or firms was going to build the lines.

Midwestern's application, which involved bringing 204 MMcf a day from Tennessee to Chicago, and a like amount from Canada to areas northwest of Chicago, was denied because the supplier, Trans-Canada, at present does not have reserves enough to supply its Canadian customers as well as Midwest.

The Northern Natural application was denied because its proposed Redfield, Iowa, storage project had not been proven adequate. Michigan Wisconsin, the FPC ruled, failed to prove the economic feasibility of its project.

"We think that, assuming the Canadian authorities will eventually permit its export, Canadian gas should and inevitably will be made available to this and probably other areas of this country," the commission said. It added that it is confident that "when more satisfactory commitments are made and supplies more adequately shown, we will find it possible to authorize its importation."

Further, the FPC said it envisions the time when it might be possible to connect systems supplied by Canadian gas with others supplied by U. S. gas so that "Canadian and American sources will be interconnected from the Gulf to Canada across the breadth of the United States."

The commission made it clear that large-diameter pipelines would be required to serve the areas involved. "We look with favor on the construction of large capacity pipeline facilities for serving the growing needs of the area," the commission said at one point. The commission also noted that pertinent parts of the record built up during consideration of the cases now denied may be used in the new proceedings simply by reference to them. This could save months of tedious testimony, and expedite final approval of some project to serve the lush areas involved.

Gas experts in Washington sensed an intention on the part of the FPC to authorize fairly soon some import project involving Trans-Canada. Although the Canadians, if recommendations of the Borden commission on energy are followed, might tend to delay issuing export certificates, these sources believe the FPC might issue a certificate and in effect force the Canadians to act.

Gas turbine operations committee, a group representing the gas, oil, chemical and petrochemical industries, visited Clark Bros. Co. in Olean, N. Y. recently. They are (from left): J. J. Rosecky, Clark Bros.; R. J. Parks, Aramco; J. E. Fenex, Petroleum Chemicals Inc.; J. E. Leo, Trans-Arabian Pipeline; C. A. Falkenhagen, Tennessee Gas Transmission; G. H. Ewing, Texas Eastern Transmission; A. H. Carameros, El Paso Natural; F. A. Cramer, Southern Counties Gas; M. M. Heller, United Gas; and R. M. Greene and R. J. Spears, both of Clark Bros.

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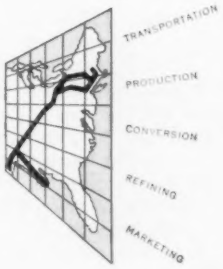


Trunkline plans gas sale to Consumers

Hearings are under way on Trunkline Gas Co.'s $81.4 million construction plan (Docket G-15394 et al).

In all, 13 applications are involved in Trunkline's proposed delivery of up to 135 MMcf a day to Consumers Power Co., Jackson, Mich. Eleven of the applications came from independent producers proposing to sell the gas to Trunkline from Texas and Louisiana fields.

Trunkline's project includes 204 miles of 26-in. line, extending its transmission system from its present terminus near Tuscola, Ill., to a point near Vistula, Ind.; about 463.8 miles of 30-in. loops between Longville, La., and Tuscola; 44.5 miles of 24-in. loop in Texas; 183 miles of supply lines; and a 3000-hp addition at its Longville compressor station. System capacity will be boosted from 375 MMcf to 510 MMcf daily.

Consumers now receives the bulk of its gas supply from Michigan Gas Storage Co., an affiliate served by Panhandle Eastern Pipe Line. The storage company has applied for a certificate to use existing facilities to transport the new gas supply.

Consumers plans to develop the Overisel and Northville fields in Michigan as storage reserves. Trunkline gas will be stored there during off-peak periods.

FPC okayed $518 million construction in past year

During the 12 months ended June 30, 1958, the FPC authorized construction of transmission facilities estimated to cost more than $518,822,000. Included were nearly 4400 miles of pipeline and about 424,000 hp in compressor units.

The new facilities, FPC Chairman Jerome Kuykendall said, add more than 2.25 billion cu ft of daily delivery capacity to the nation's individual transmission systems.

Major projects — those costing $700,000 or more — accounted for more than $494 million of the total construction cost. These projects will boost daily delivery capacity of individual transmission systems by more than 2.2 billion cu ft daily, and include about 3600 miles of line and more than 409,000 compressor hp. One hundred and thirty-two cities of 50,000 population or more in 24 states and the District of Columbia, as well as many smaller communities, will benefit.

El Paso (Texas) Natural Gas Co.'s $105 million project was the largest single authorization. This will add new gas reserves to the company's system and increase its daily sales capacity by 185 MMcf. Included are 216 miles of 6- to 34-in. mainline loops and laterals, 533 miles of 2- to 24-in. field supply laterals, and 86,750 hp in compressor units.

Since February 1942, when certificate provisions of the Natural Gas Act became effective, the FPC has authorized construction of nearly 80,000 miles of pipeline, more than 5.4 million hp in compressor units, and miscellaneous equipment to the tune of $6.4 billion. Authorized during that time were projects designed to add more than 30 billion cu ft of daily delivery capacity.

Chairman Kuykendall pointed out that construction activity during the current period does not reflect the full increase in available supply and transmission of gas. This, he said, is because of the increasing number of projects being authorized that involve the improvement and assurance of service to customers through the acquisition of new and additional gas reserves and also the expansion of storage facilities.

Leidy underground storage facility—a joint operation of New York State Natural, Transcontinental Gas Pipe Line, and Texas Eastern Transmission—is under construction. Here, gas compressor engines are being unloaded for use in the first section of the compressor building. The engine at right is a 2000-hp unit.

1958 rate hike requests reached $92.5 million

Thirty-three rate increase applications, totaling $92.5 million annually, were filed with the FPC during the fiscal year ended June 30, 1958. This compares with 32 increases totaling $95.1 million filed during the preceding fiscal year.

The FPC suspended 22 of the 33 proposed hikes, amounting to $89.3 per year. The other 11 were allowed to take effect without suspension.

At the beginning of the year, there were 41 rate increases amounting to $178 million in suspension proceedings. During the year, 10 increases and partial settlements in the amount of $55.9 million annually were disposed of by final commission action. Rate increases allowed amounted to $34.5 million annually. Increases totaling $24.6 million per year were disallowed or withdrawn.

The dollar volume backlog of suspended rate increase proceedings increased from $178 million at the end of the 1957 fiscal year to $211.5 million at the end of fiscal '58.

A total of 928 rate filings, exclusive of those made by independent producers, were made by natural gas companies in 1958, as compared with 923 filings in 1957.

Am-La gets permanent ok; Panhandle plan deferred

The FPC has agreed with a presiding examiner (see GAS, August, p. 144), and issued American Louisiana Pipe Line Co. a permanent certificate to increase its system capacity by 35.7 MMcf daily (Dockets G-10396, G-10400 and G-11061). The $7.4 million program will boost AmLa's capacity to 357 MMcf.

The FPC deferred decision on a

request by Panhandle Eastern Pipe Line Co. to abandon gas sales to Michigan Consolidated Gas Co., an American Louisiana affiliate.

Although the commission's action affirms the examiner's decision, the FPC said that "With respect to Panhandle's application for abandonment of service, we have decided to defer decision for further deliberation and consideration."

Transco's third line plan goes to FPC for approval

Transcontinental Gas Pipe Line Corp. has taken the first step in its long-range program to build a third line from the Gulf Coast to its market in the Philadelphia-New York-New Jersey area.

The newly announced plan covers expenditure of $51 million to increase daily allocations to 43 customers by 82 MMcf, plus an increase of 8 MMcf daily transported for Sun Oil Co. Transco currently transports 20 MMcf of firm gas per day for Sun to the latter's refinery at Marcus Hook, Pa.

This phase of the program is slated for completion by November 1959.

E. Clyde McGraw, Transco president, said the 1959 program is in addition to the $167 million major program now under way. More than half of this big job will be completed by the end of the year, enabling Transco to meet present commitments this winter for increased deliveries of natural gas, he said.

In its new application filed with the FPC, Transco proposes to build 149 miles of additional 36-in. mainline loops and 34 miles of 20- and 24-in. additional gathering laterals. Two new compressor stations, one in Nueces county, Texas, and one in St. Helena parish, La., are proposed. Also, additional compressors would be installed at eight of the 25 existing Transco mainline compressor stations.

The 1959 construction applied for will increase total proposed daily allocations to 1281 MMcf, exclusive of storage, and to 1621 MMcf per day including natural gas from storage properties.

TGT completes acquisition of Hartol Petroleum

Tennessee Gas Transmission Co., Houston, has completed acquisition of the common stock of Hartol Petroleum Corp.

A total of 467,098 shares of TGT common was exchanged for Hartol common on a basis of 81 shares of Tennessee for each Hartol share. Current market value of the Tennessee common exchanged was more than $14 million.

Hartol will continue under its present management and will operate as a separate subsidiary of TGT. Hartol is the largest independent wholesale marketer of gasoline, kerosene and No. 2 and No. 4 fuel oils on the Eastern Seaboard.

The Hartol board has been reorganized to include Tennessee Gas representation. W. C. Burns will continue as Hartol president. TGT's president, Gardiner Symonds, was elected Hartol chairman. R. R. Dean, TGT senior vice president and president of the company's Bay Petroleum Corp. subsidiary, is vice chairman. Harold Burrow and C. C. Johnson are the other new board members.

Manufacturers' stopping of retail sales okayed

FPC has okayed Manufacturers Light & Heat Co.'s abandonment of retail gas sales in Ohio (see GAS, October, p. 182). Under the plan (Docket G-14691), Manufacturers, located in Pittsburgh, will deliver gas at wholesale to its affiliate, the Ohio Valley Gas Co., Columbus.

Ohio Valley will resell the gas to Manufacturers' present retail customers. The realignment is part of the Columbia Gas System plan to make each operating subsidiary subject to regulation by only one regulatory agency.

Under the new arrangement, Manufacturers' interstate operations will remain subject to FPC jurisdiction and the Ohio retail sales made by Ohio Valley will be under jurisdiction of the Ohio PUC.

Northern's application heard by commission

Hearing is under way on Northern Natural Gas Co.'s $15.9 million construction plan (Dockets G-14697 and 14779).

Northern's proposal covers about 103.7 miles of 30-in. mainline loops; 18 miles of 20-in. line; 3.5 miles of 10-in. branch line loops; 14,000 additional compressor hp; and a measuring station. Building site: Kansas, Nebraska, and Iowa.

With the new facilities, Northern will supply its existing customers with an additional 50.7 MMcf daily in contract demand required by them for the 1958-59 heating season (G-14779). Also, it will sell up to 50 MMcf daily to Northern Illinois Gas Co., Aurora, Ill. (Docket G-14697).

El Paso plans exchange with Pioneer Gathering

El Paso (Texas) Natural Gas Co. is seeking (Docket G-15243) approval of its plan to exchange gas with Pioneer Gathering System Inc., Amarillo.

El Paso's application said that it has gas reserves in the Vinegarone field in Val Verde county, Texas, and Pioneer has reserves committed to it in the Sonora area of Sutton county, Texas. El Paso proposes to spend $849,000 on facilities to effect the exchange of gas.

Houston-Coastal line changes approved

Plans to alter the size and length of Houston-Coastal's Texas-to-Florida pipeline have been okayed by the FPC.

Houston Texas Gas & Oil Corp. will reduce the length of its mainline from 942.6 to 914.2 miles. Laterals will be boosted from 682.5 to 701.7 miles. Coastal Transmission Corp. will reduce its mainline from 574.4 miles to 562.4. The aggregate length of its lateral lines—414 miles—will not be changed.

The companies also revised the estimated cost of the project to $103,107,000 for Houston and $59,366,000 for Coastal. Original estimates (1956) were $94,285,000 for Houston and $54,279,000 for Coastal.

Southern gets new Mississippi supply

FPC approval was given to Southern Natural Gas Co.'s plan to take 27 MMcf daily from the Dexter field in Walthall and Marion counties, Miss.

Under Docket G-14560 et al, Southern Natural will spend some $219,520 on new facilities. Southern will pay 20.25 cents per Mcf for the gas, plus state taxes.

FPC presiding examiner Harry W. Frazee said the acquisition of the Dexter field gas is part of Southern's long-term program of securing additional reserves. He

Final weld completes physical construction of Trans-Canada Pipe Line's 2294-mile line from Alberta to Montreal. Scene: Kapuskasing, northern Ontario. The welder, wearing leather windbreaker and hip waders to protect him from cold, rain, and mud, worked from a platform in the water-logged ditch under conditions typical of the final stage of construction.

said that Southern has a ready market for this gas, and had shown that two of its largest customers approved the purchase at the proposed price.

California okays new out-of-state connection

California's PUC approved Pacific Lighting Gas Supply Co.'s construction of a 128-mile, 34-in. line to bring 300 MMcf of gas a day to southern California.

Approval of the $18.6 million project is subject to the FPC issuing a certificate to Transwestern Pipeline Co., the new out-of-state supplier.

The contract with Transwestern calls for delivery of the initial 300 MMcf at the California-Arizona border near Needles.

Transwestern's president, Mills Cox, said in Houston that the FPC has set Dec. 15 as hearing date on his company's plan—a 1305-mile line from Texas to California.

Joint line proposed for Canada's Alberta gas

While a move in the right direction, the proposal of Westcoast Transmission Co. Ltd., and Alberta & Southern Gas Co. to use the same line to move gas to the U. S. from Canada may be delayed two or more years—if the proposals of the Borden Commission are adopted by the Canadian government (see Washington column).

The companies originally proposed construction of two lines to serve expanding markets on the U. S. Pacific Coast. The Alberta Oil & Gas Conservation Board recently deferred their applications to build separate lines. The new plan resulted from this action.

Now A&S and Westcoast plan to build a 105-mile, 36-in. line from the Alberta border through the Crowsnest Pass area of southern Alberta to the British Columbia-Idaho boundary. Cost is estimated at $40 million.

There would be no other basic change, however, in the original proposals of the two companies planning to export Alberta gas to different customers.

The Alberta board ruled there isn't enough gas in the province to meet the two firms' requirements and still satisfy future Canadian needs. The available surplus for pipeline use, however, was not far short of the combined requirements of the two companies.

The new line—paralleling A&S's original plan—will be operated by Alberta Natural Gas Co., in which both firms will have equal stock interest.

Agreement was reached by Westcoast President Frank McMahon and Alberta & Southern's J. K. Horton after studies indicated substantial savings in transportation costs.

Alberta & Southern's line is destined for the northern and central California market of Pacific Gas & Electric, San Francisco. Westcoast sells its gas to Pacific Northwest Pipeline Co.

SRS • Pipeline Notes

Mississippi River Fuel Corp., St. Louis, got the FPC's nod of approval on its plan to purchase and transport gas from Arkansas Louisiana Gas Co. (Dockets G-15187 and 15190). Mississippi will spend about $3.6 million to build 36.8 miles of 26-in. transmission loops; 3.8 miles of 10-in. laterals; and a 1320-hp compressor station at Minden, La. Arkansas Louisiana will build a 1320-hp compressor and metering station and sell up to 35.7 MMcf daily to Mississippi.

Permian Basin Pipeline Co.'s plan to get a gas supply from the Emperor field in Winkler county, Texas, has been okayed (Docket G-13792, et al). About 60.9 miles of 16-in. laterals, 11.3 miles of field lines and 9 metering stations will be built at a cost of $3.6 million.

Temporary approval has been given Texas Gas Transmission Corp.'s plan to provide an additional 30.9 MMcf daily delivery capacity for its existing customers (Docket G-15320). Texas Gas will spend $2.4 million on 20 miles of loop; an additional 2440 hp in two compressor stations; and appurtenant facilities in Louisiana, Kentucky, Indiana, and Illinois. In addition, Texas Gas is expanding existing storage facilities in Indiana and Kentucky.

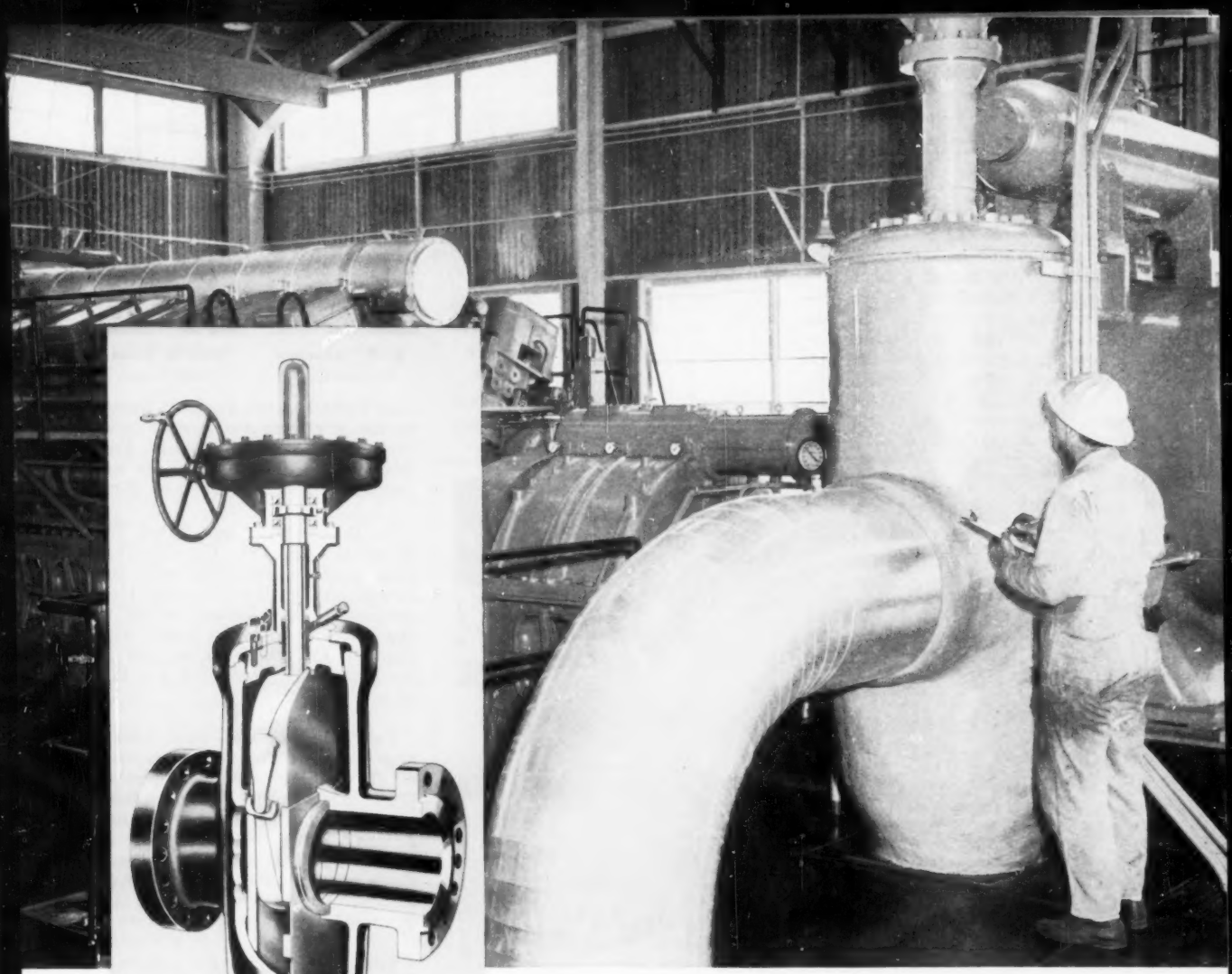
Atlantic Seaboard Corp.'s $2.4 million construction plan (Docket G-15129) was okayed by the FPC. The 12 miles of 26-in. loops in West Virginia and 11.7 miles of 26-in. loops in Virginia will enable Atlantic to overcome a 62.1 MMcf deficiency in its system capacity.

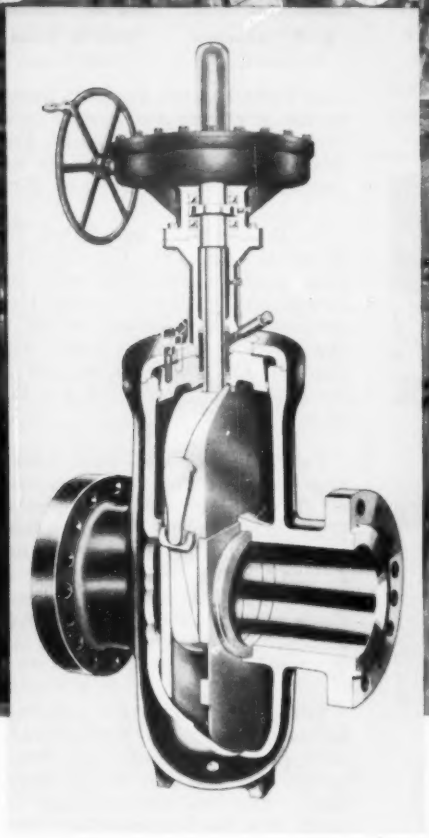
Temporary authority was granted El Paso Natural Gas Co., which wants to spend some $4.8 million to get a gas supply from the East Maljamar and Kemnitz areas in Lea county, N. M. (Docket G-15068). El Paso will acquire the 3520-hp Kemnitz field compressor station from Tennessee Gas Transmission and increase its capacity to 4480 hp; build 4650 hp in two new compressor stations; and 39 miles of field lines and 16.7 miles of fuel pipeline. With these facilities, El Paso can buy about 27 MMcf daily.

Transcontinental Gas Pipe Line Corp.'s $2.3 million plan to boost its mainline capacity by 25 MMcf per day has been okayed (Docket G-12059). Some 15.1 miles of 36-in. mainline loops will be built.

One of the cooling tower industry's most complete lines was recently created through the merger of Dover Manufacturing Co., Independence, Mo., with J. F. Pritchard & Co. of California, Kansas City, Mo. The composite company will operate under the Pritchard of California name.

The 1957 edition of the FPC's annual publication, "Statistics of Natural Gas Companies," is available from the Superintendent of Documents, Washington 25, D. C., for $1.00 per copy.





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GAS Pipeline People

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Houston Corp.

B. G. Bennett
Houston Corp.

E. P. Shanahan
Houston Corp.

Jack D. Head
Texas Eastern

PAUL T. PRIESMEYER has been appointed chief engineer of Houston Corp., and has moved from Houston to the company headquarters in St. Petersburg, Fla. Priesmeyer is a graduate gas engineer from Texas A&I. He held key engineering posts in the Texas administrative office and Houston division of United Gas Corp. for nine years. He joined Transcontinental Gas Pipe Line Corp. as a design engineer in 1957 and was in that post when he accepted his current appointment.

J. KENT DUVALL has been named to the newly created post of pipeline engineer for Mountain Fuel Supply Co., Salt Lake City. He will headquarter at Rock Springs, Wyo.

G. B. BENNETT has joined the Houston Corp., St. Petersburg, Fla., as vice president of sales and operation for the distribution properties. Mr. Bennett comes to the company after 20 years with Sun Oil Co. where he worked in the production, processing and sale of gas.

JACK D. HEAD has been named vice president and general counsel of Texas Eastern Transmission Corp., Shreveport. Mr. Head succeeds CHARLES I. FRANCIS, who has retired. He has been serving as assistant general counsel for Texas Eastern since 1956. Prior to that, Mr. Head was active in legal affairs of the company.

ROBERT HUGHES has been appointed director of research and development of Dravo Corp., Pittsburgh. He replaces W. L. NEWHALL, who has retired after 33 years with the company. DR. JOHN A. ANTHES has been named assistant director of research and development.

Heading up El Paso Natural Gas Co.'s new geological and land office in San Antonio, Texas, is HAL S. DEAN. Other personnel include BOB STURDIVANT as landman and NOLAN A. JETER, a geologist, both transferred from Midland, and J. W. RIDDLE, office manager, who transferred from Sonora, Texas.

E. P. SHANAHAN has joined Houston Corp. as vice president and comptroller. He will serve in the same capacities with the company's subsidiaries, Houston Texas Gas & Oil Corp. and Coastal Transmission Corp.

BRUCE JONES is now manager of supply and distribution for La-

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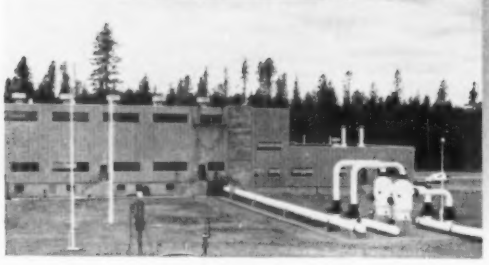

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TOM P. WALKER, formerly board chairman of Transcontinental Gas Pipe Line Corp., Houston, has been named special representative of Pandick Press, Inc., with headquarters in Houston. Although retired as chairman of Transco, Mr. Walker retained his membership on the company's board of directors. Pandick Press is a New York firm specializing in annual reports and other financial printing.

Cooper-Bessemer Corp., Mt. Vernon, Ohio, has made several appointments in its field offices. In the New Orleans office, FREEMAN A. GEHRES has been promoted to branch office manager. He succeeds T. E. Kraner, who has become president of the company's new subsidiary, C-B Southern, Inc. Mr. Gehres has served as assistant branch manager since 1952. WILLIAM J. BURKSTALLER has transferred from the Odessa office to New Orleans where he assumes the duties of sales engineer for the application of centrifugal and reciprocating compressors. Also new to the New Orleans operation is GILBRETH D. ADAMS who will assist in engineering and sales relative to the application of centrifugal and reciprocating compressors for chemical and processing industries. SVEN T. G. SWANBERG has been assigned to Cooper-Bessemer's New York field office in an engineering and sales capacity. PHIL S. HURST has been promoted to assistant product manager, gas engine compressor sales. Since joining Cooper-Bessemer, Mr. Hurst has been associated with the sales engineering section, for which he has now been made assistant manager.

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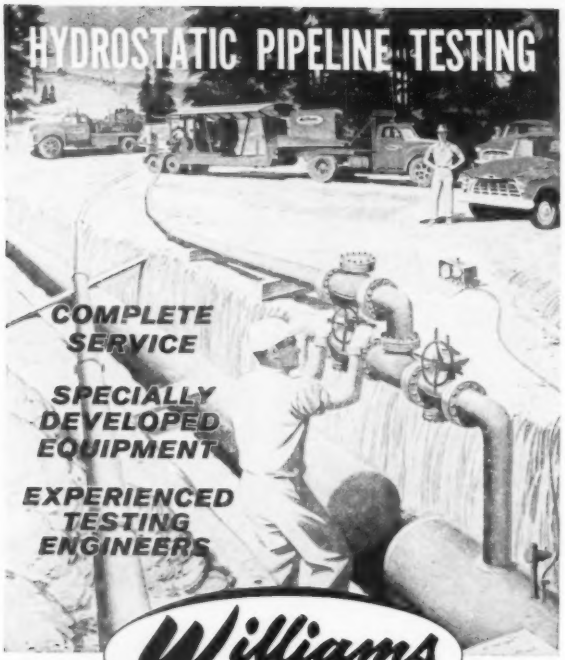

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pipeline people • *Cont'd.*

KENNETH L. BISHOP to superintendent of Ting compression station at Conroe, Texas, succeeding CHARLES L. COCHRAN, who has resigned; VERNON L. EBELING to superintendent of NGPL's station at Gray, Okla., succeeding Bishop, and TED CHEUVRONT to superintendent of the NGPL station at Mt. View, Okla.

Buflovak Equipment division, Blaw-Knox Co., Buffalo, has appointed BART DE LORENZO and WILLIAM G. WHITE of the Barth Engineering Co., Oakland, Calif., as sales representatives in California.

OTIS G. BRYANT is the new chief engineer for Houston (Texas) Pipe Line Co. Bryant joined Houston Natural Gas Corp. in 1949 as a field engineer. Following Houston Natural's acquisition of Houston Pipe Line in 1956, he transferred to the new subsidiary as senior engineer in 1957.

Clark Bros. Co., division of Dresser Industries, Olean, N. Y., has opened a Denver, Colo., branch office. JAY B. WILLIAMS is manager. Williams formerly was assistant manager in Clark's Tulsa office. The new office has been established to provide closer and more frequent contact with customers throughout Colorado, Wyoming and Montana.

FRANK D. STOCKMAN and VINCENT E. MARTINSON have been promoted to managerial posts in the gas supply department of Northern Natural Gas Co., Omaha. Stockman is manager of the reserves and availability division while Martinson is manager of the underground storage divisions.

GEORGE C. PFAFF has retired as manager of the Gas Apparatus department of Koppers Co., Inc., Baltimore, Md., after 43 years of service. At the same time, it was announced that the Coke Oven department has been consolidated with gas apparatus and G. V. MIDDAUGH has been appointed manager.

DR. WESLEY D. SCHROEDER has been promoted to manager-product research for activated carbon and industrial chemicals in the research and development department of Pittsburgh (Pa.) Coke & Chemical Co.

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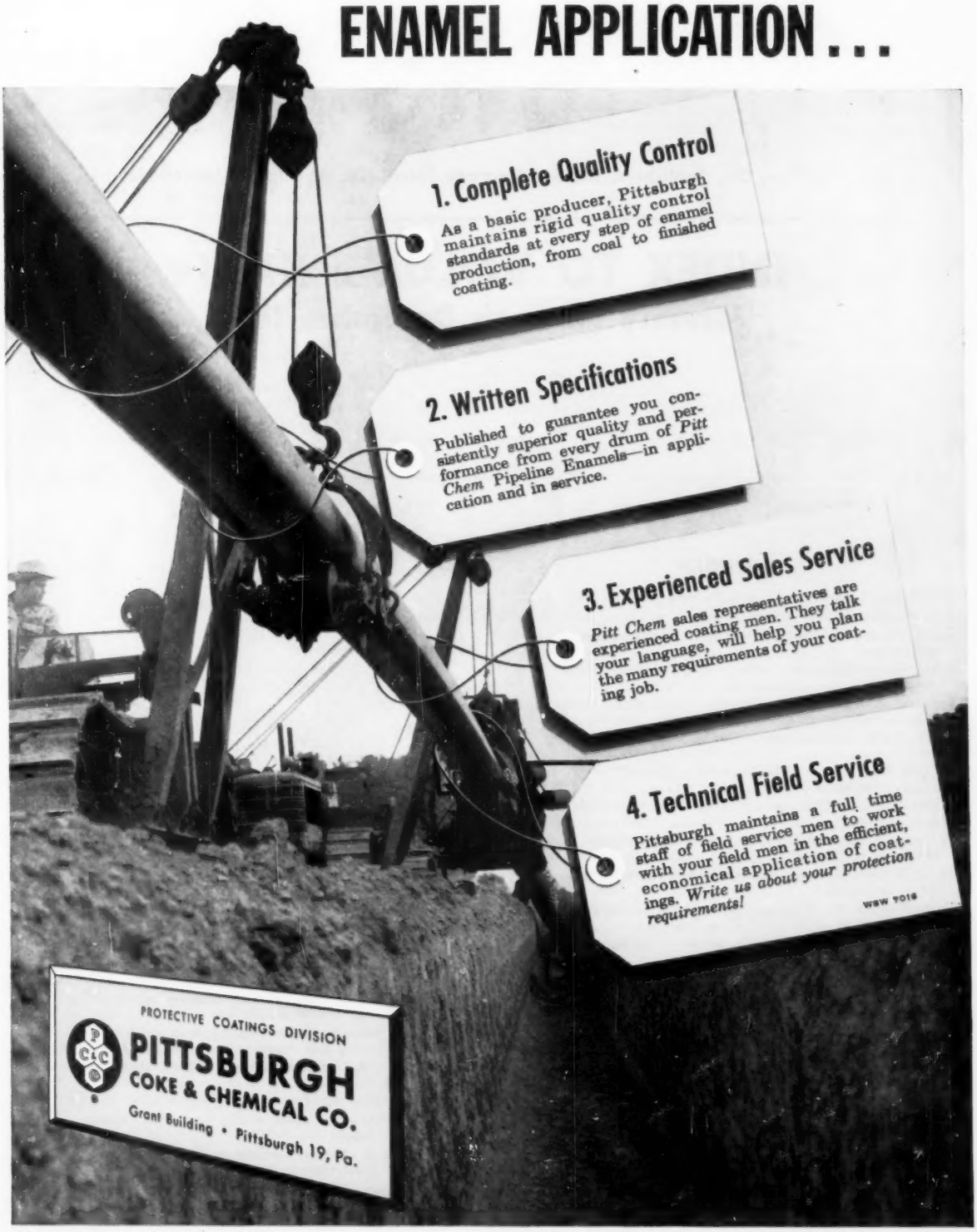
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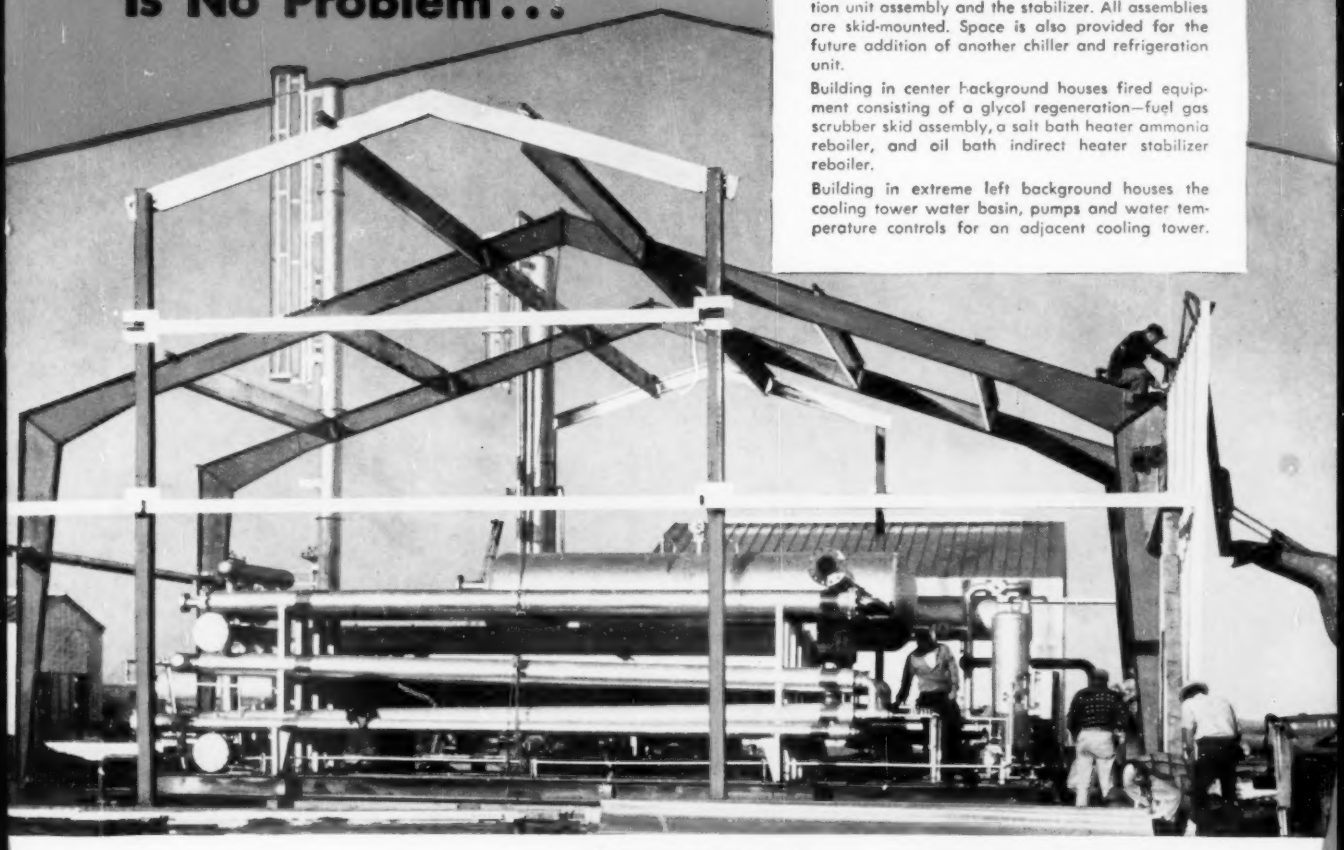

Partially completed building in the foreground houses the COLD-FRAC assembly, the chiller and pump gas scrubber assembly, the 66-ton refrigeration unit assembly and the stabilizer. All assemblies are skid-mounted. Space is also provided for the future addition of another chiller and refrigeration unit.

Building in center background houses fired equipment consisting of a glycol regeneration—fuel gas scrubber skid assembly, a salt bath heater ammonia reboiler, and oil bath indirect heater stabilizer reboiler.

Building in extreme left background houses the cooling tower water basin, pumps and water temperature controls for an adjacent cooling tower.

In This BS&B COLD-FRAC Gasoline Plant Built For Provost Viking Gas Unit

Approximately ten miles north of Consort, Alberta, Provost Viking Gas Unit recently put a new natural gas compression and dew point control plant on stream which *automatically* adjusts to variations in the flow rate of the inlet gas. BS&B designed and furnished all process equipment in this plant exclusive of compression.

Compressed gas at 800 psi is processed through BS&B COLD-FRAC low temperature separation equipment utilizing ammonia absorption refrigeration, to produce gas with 15° F. maximum hydrocarbon and water vapor dew points. A BS&B stabilization unit processes the condensed hydrocarbons to provide a 14# RVP gasoline.

The plant is presently equipped to process up to 44 MMSCFD, but future expansion has been provided for by the installation of a compressor suction scrubber and a low temperature separator designed to process up to 88 MMSCFD at 800 psi working pressure.

If your future plans call for the installation of a gasoline plant, why not talk it over with your BS&B Man? He'll gladly analyze the problem with you and will recommend the best combination of equipment to meet your requirements. Or, you may write to . . .

EFFICIENCY OVER 40 YEARS RELIABILITY BS&B ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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